Report

Phase III – Comprehensive Wastewater Management Plan and Final Environmental Impact Report

Nantucket, Massachusetts

Volume I of III

Prepared for:

Nantucket Department of Public Works
188 Madaket Road
Nantucket, Massachusetts 02554-2623

Prepared by:

Earth Tech, Inc.
196 Baker Avenue
Concord, Massachusetts 01742-2167

March 2004

27355

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March 31, 2004

Dear Project Reviewer:

Enclosed please find one copy of the report entitled "Comprehensive Wastewater Management Plan and Final Environmental Impact Report Phase III (Phase III Report) completed in accordance with the Massachusetts Department of Environmental Protection's "Guide to Wastewater Management Planning" dated January 1996. The review of the Comprehensive Wastewater Management Plan (CWMP)/Environmental Impact Report (EIR) will be through the submission of three documents including: (1) Phase I Report; (2) Phase II CWMP/Draft EIR; and (3) Phase III CWMP/Final EIR.

This Phase III Report is consistent with the general requirements of the MEPA regulations including being circulated per MEPA regulations at 301 CMR 11.16 (3). In addition, six (6) copies will be available for public review at the Selectmen and Town Clerk's Offices in the Town Hall, Department of Public Works, Nantucket Land Council, Nantucket Planning and Economic Development Commission and at the Antheneum (Public Library). The complete Report can also be accessed through the Town's website at www.nantucket-ma.gov. The circulation list is included in Section 7 of the Phase III Report.

A public hearing on the Phase III Report will be initiated by a notice of availability for review in the Environmental Monitor. A responsiveness Summary will be completed as a result of the Public Hearing and included in the permanent record.

If you have questions regarding this project, please do not hesitate to contact the MEPA office at 617-626-1000.

Very truly yours,
Earth Tech, Inc.

Thomas E. Parece, P.E.
Senior Program Director

enclosures

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EXECUTIVE SUMMARY

In 1998, the Nantucket Department of Public Works retained Earth Tech, Inc. to prepare an Island-wide Comprehensive Wastewater Management Plan/Environmental Impact Report (CWMP/EIR) to identify areas within the Island with sub-surface wastewater disposal problems and to develop a plan to mitigate or eliminate the problems. The Town established a special procedure for the review of this major and complicated project. This special procedure is a three-phase process during which the scope of future phases is based largely on the results of the preceding phase. The process consists of filing three documents: (1) Phase I, Needs Analysis; (2) Phase II, Alternatives and Site Identification and Draft Environment Impact Report; and (3) Phase III, Comprehensive Wastewater Management Plan and Final Environmental Impact Report. The results of the three-phase plan are included in this Document. This Document provides the basis for the design and ultimate implementation of the approved plan.

This Document contains the results of extensive efforts by Earth Tech, Inc. and the Town of Nantucket to evaluate the available options for improving the existing on-site wastewater disposal systems. In order to obtain as much information as possible on the existing and projected land use, demographic conditions and population, Earth Tech Inc., coordinated efforts with the Nantucket Planning and Economic Development Commission (NP&EDC) and the Massachusetts Estuary Project (MEP). The goals of the NP&EDC's, "The Nantucket Comprehensive Plan", coupled with the on-going Massachusetts Estuary Project (MEP) have been utilized in evaluations and analyses for the community presented in this Document and have been an integral force in the formation of the final recommendations herein.

The MEP is currently gathering data in the Nantucket Harbor and Sesachacha Pond areas in order to provide technical data relative to the maximum amount of nitrogen (nitrogen threshold) that each estuary can tolerate without adversely changing its character and use. Madaket Harbor is also being studied but at a different target date than the above-mentioned areas. MEP will set the target to be achieved in order to protect and restore the health of the estuaries. Study areas affected by the MEP include Wauwinet, Quidnet, Pocomo, and Polpis. Until the MEP data is completed, these areas are recommended to continue using on-site wastewater disposal systems managed under a Septage Management Plan. Once the MEP data is complete, these areas will be further evaluated for long-term recommendations.

A recommended solution is being made for Madaket in this Report, which has been classified as a Need Area based on multiple criterion identified in the Phase I Report. The MEP in the Madaket Harbor area will further define the need for reducing nitrogen loadings to the estuaries here. This could mean redefining the wastewater treatment level necessary to meet the goals of the MEP in Madaket. The CWMP/EIR is an evolving and acquiescent process. It is recommended that the Town continue the coordination of efforts on Island with the MEP.

Other agencies utilized for information and considered herein are U.S. Soils Conservation Services, U.S. Department of Agriculture, U.S. Coast Guard, local planning officials, the Nantucket Historic Commission, the Natural Heritage Program, and local Town boards including Assessors, Building Department, Board of Health, Public Works Department, Zoning Officials, Conservation Commission and Nantucket Planning and Economic Development Commission.

The Phase I, Needs Analysis was completed and filed with MEPA in August 2001. An Environmental Notification Form (ENF) was filed with MEPA in October of 2001. The Phase I Document determined the areas on Island incapable of sustaining long-term, on-site wastewater disposal systems throughout and beyond the 20-year planning period. There were ten Study Areas identified as Needs Areas:

Madaket	Shimmo
Monomoy	Pocomo
Pocomo	Polpis
Polpis	Warrens Landing
Quidnet	Wauwinet

See the map at the end of this Executive Summary for a description of the challenges and solutions for each of the ten identified Study Areas.

The Phase II, Alternatives and Site Identification, was completed and filed with MEPA in September 2003. The Phase II Document analyzed the selected alternatives in accordance with the revised scope that was issued by the Secretary of EOEA and comments received on the Phase I CWMP/EIR document.

The Phase II CWMP/DEIR document contains the preliminary investigation into the viability of siting wastewater treatment facility(s) and/or highly treated wastewater effluent disposal facilities on Nantucket. Site selection, for both the wastewater treatment facilities (WWTFs), and the effluent disposal field(s) is the most difficult to resolve. The screening criteria presented in this section were developed to assess the

viability of 14 sites identified within Nantucket as potential wastewater treatment facility and/or wastewater disposal facility sites. The screening criteria used to evaluate these potential project sites were based upon eleven environmental criterion. The environmental screening criteria were chosen based upon review by the Project Proponent and upon comments received by the Proponent in the Secretary of the Executive Office of Environmental Affairs Certificate on the ENF dated October 2001. It was determined that by applying the screening criteria to the 14 identified sites a short list of selective potential sites would be established for additional evaluation through field testing. The screening criteria chosen to evaluate the potential project sites are: (1) wetlands; (2) soils; (3) drinking water supply - wellhead protection areas (Zone I and Zone II); (4) fisheries (including shellfish areas); (5) waterbodies (distance from surface water); (6) floodplains; (7) sensitive habitats; (8) park lands; (9) recreational resources;
(10) agricultural/historical interests; (11) shoreline change data; and (12) in or adjacent to an Area of Critical Environmental Concern.

Wastewater treatment options were evaluated based on four levels of criteria. The first criterion, Technical Factors, included flow and loading, land/site requirements, suitability for groundwater discharge, climate, sludge disposal and ease of operation. The second criterion, Environmental Factors, included groundwater and permitting impacts. The third criterion, Institutional Factors, included community acceptance, regulatory and legal issues. The fourth criterion, Economic Factors, included construction cost and operations cost. Various wastewater treatment technologies were evaluated based on the above criteria and the Town of Nantucket's goals regarding the operation and maintenance of the facilities.

The Phase II CWMP/DEIR document presents recommendations for wastewater management in the above-mentioned ten identified areas of the Town of Nantucket where existing on-site wastewater disposal systems are shown to be inadequate for long-term wastewater disposal. Specific recommendations by Study Area have taken into account the appropriateness of utilizing: (1) innovative alternative systems; (2) communal systems; and (3) local wastewater collection, treatment, and disposal facilities. The Phase II CWMP/DEIR document evaluated the environmental impacts, technical design, institutional factors, and project costs associated with each alternative and recommends the appropriate solution to the wastewater disposal problems in the Town of Nantucket on a long term basis, with the exception of those areas included in the MEP Study Areas.

The Phase II CWMP/DEIR document recommends that the Town of Nantucket upgrade the existing Surfside Wastewater Treatment Facility, construct a new Madaket Wastewater Treatment Facility and provide sanitary sewer via low pressure sewers and/or gravity sewers to five needs areas (Madaket, Monomoy, Shimmo, Somerset and Warrens Landing), and to prepare a Septage Management Plan for the remainder of the Island. The recommended plan is the most environmentally sound and cost-effective alternative, and insures the sustainability of Nantucket's water resources for centuries to come. The recommended plan is proposed to be designed and constructed over a twelve-year period and has been divided into seven construction phases. The construction phases were developed based on: (1) the need of an area to be serviced; (2) funding constraints; and (3) minimizing construction related disruptions within the Town. The capital cost of the recommended plan is estimated at $92.1 million and includes construction, engineering (design and construction), legal, fiscal, administrative, and contingency costs for providing sanitary sewerage to the five needs areas, and the construction of the Surfside WWTF upgrade and Madaket WWTF. The CWMP/EIR is a dynamic and flexible long-term planning document, therefore, the Town has the opportunity to incorporate any additional information that is developed by Federal, State and/or Local authorities and/or private entities prior to the implementation of the recommendations, if appropriate.

The Secretary issued the MEPA Certificate for the Phase II, EOEA Number 12617, on December 1, 2003.

After filing the Phase II CWMP/DEIR on October 30, 2003, the Town of Nantucket entered into an Administrative Consent Order (ACO), ACOP-BO-03-1G002, with the DEP in the matter of the Surfside Wastewater Treatment Facility. The implementation schedule contained in this Phase III Document coincides with the schedules detailed in the ACO. The complete ACO is included in Appendix A.

In addition to the CWMP/EIR, the Town has been involved with an Evaluation and Mapping project for its wastewater and stormwater infrastructures. The project involves the review, investigation and mapping of the infrastructures and recommended rehabilitation/upgrades required based on existing and future needs. The capital cost of the recommended plan is estimated at $83.4 million and includes construction, engineering (design and construction), legal, fiscal, administrative, and contingency costs over a 20-year planning period. One of the major parts of the Evaluation and Mapping project is the initial investigation of infiltration/inflow within the existing wastewater infrastructure and recommendations to reduce excessive groundwater from entering the wastewater collection system. Since the Evaluation and Mapping project is scheduled to be completed in the Summer of 2004, adjustments to the recommendations and associated estimated capital costs may be necessary.

This Phase III, Comprehensive Wastewater Management Plan and Final Environmental Impact Report (CWMP/FEIR) is the final result of all comments received on the Phase II Report through the MEPA process as well as comments received during multiple public informational meetings and workshops held on the Island and incorporates the provisions contained in the Surfside ACO. The Phase III, CWMP/FEIR, contains the final recommended plan for long-term wastewater collection, treatment and disposal as well as all associated costs for users and non-users. A Septage Management Plan is completed in draft form for those areas on Island determined to be long-term sustainable with on-site wastewater disposal systems.

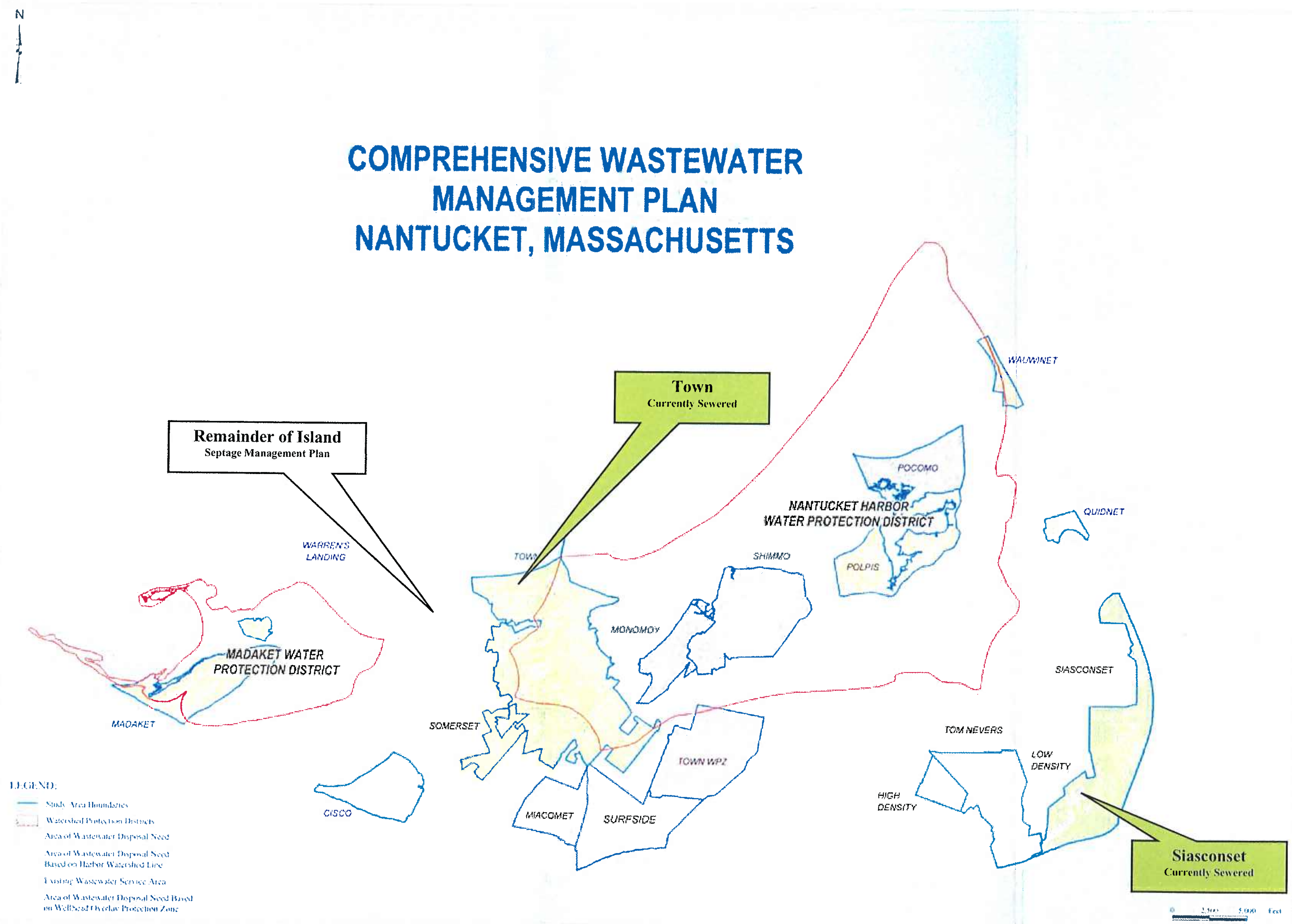
These projects have spearheaded the Town’s efforts to develop a long-term Capital Improvement Program that incorporates not only the recommendations from the CWMP/EIR and Evaluation and Mapping projects, but other Town Department budget expenditures as well. This proactive agenda will allow the Town to act fiscally responsible and ensure the long-term sustainability of the Island while protecting the environment and sole source aquifer at the same time both of which are direct goals the State’s Watershed Initiative.

In summary, both the CWMP/EIR and Evaluation and Mapping projects are dynamic and flexible long-term planning documents that leave opportunities open to modifications by the Town to incorporate any additional information that is developed by Federal, State and/or Local authorities and/or private entities prior to the implementation of the recommendations, if appropriate.

COMPREHENSIVE WASTEWATER MANAGEMENT PLAN NANTUCKET, MASSACHUSETTS

Challenge:
Evaluate alternatives for a 20-year solution to wastewater collection, treatment and disposal needs of the Town.

Solution:
An Island-wide study to maintain and/or improve environmental conditions while determining costs, benefits for long-term sustainability, protection of the sole source aquifer and public health, and preservation of Nantucket Harbor, Madaket Harbor, Polpis Harbor and Sesachacha Pond.



Area of Wastewater Disposal Need Based on Wellhead Overlay Protection Zone

Town WPZ
Challenge
- Wellhead Protection Zone
- Private Water Supply & Wastewater Disposal

Solution
- Connect into Existing Wastewater System

Area of Wastewater Disposal Need Based on Harbor Watershed Line

Pocomo
Challenge
- Nantucket Harbor Watershed
- High Groundwater
- Private Water Supply & Wastewater Disposal

Solution
- Septage Management Plan

Monomoy
Challenge
- Nantucket Harbor Watershed
- Private Water Supply & Wastewater Disposal

Solution
- Connect into Existing Wastewater System

Shimmo
Challenge
- Nantucket Harbor Watershed
- Private Water Supply & Wastewater Disposal

Solution
- Connect into Existing Wastewater System

Area of Wastewater Disposal Need

Madaket
Challenge
- Small Dense Lots
- Madaket Harbor Watershed
- Private Water Supply & Wastewater Disposal

Solution
- Decentralize Wastewater Treatment

Polpis
Challenge
- Nantucket Harbor Watershed
- Degradation of Polpis Harbor
- High Groundwater
- Private Water Supply & Wastewater Disposal

Solution
- Septage Management Plan

Quidnet
Challenge
- Topography
- Small Dense Lots
- Private Water & Wastewater Disposal

Solution
- Septage Management Plan

Somerset
Challenge
- Small Dense Lots
- Private Water & Wastewater Disposal

Solution
- Connect into Existing Wastewater System

Warrens Landing
Challenge
- Madaket Harbor Watershed
- Small Dense Lots
- Private Wastewater Disposal

Solution
- Decentralize Wastewater Treatment

Wauwinet
Challenge
- Small Dense Lots
- Private Water Supply & Wastewater Disposal

Solution
- Septage Management Plan

Prepared For: Town of Nantucket, Department of Public Works, 188 Madaket Road, Nantucket, MA 02554
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Prepared By: Earth Tech, Inc., 196 Baker Avenue, Concord, MA 01742, Contact: Mr. Thomas Parece, P.E., 978-371-4142
Date Prepared: June 2003 (Revised: March 2004)

Section 1.0

Information Update Request of the Phase I MEPA Certificate

1.0 INFORMATION UPDATE REQUEST OF THE PHASE I MEPA CERTIFICATE

A. NEEDS ANALYSIS DISCUSSION UPDATE

1. Introduction

A Town wide Needs Analysis was performed to determine whether or not conventional Title 5 on-site systems will be effective in disposing of wastewater within a given study area throughout and beyond the 20 year planning period. A "Needs Area" is defined as a Study Area where a majority of the developed or developable properties located within the Study Area will not be able to utilize a conventional Title 5 septic system to effectively dispose of wastewater throughout and beyond the 20-year planning period. Data obtained from Board of Health records, Assessor's files, and soil surveys of Nantucket performed by the U.S. Department of Agriculture were used to ascertain current land uses, associated soil and groundwater conditions, and to identify wastewater disposal problem areas. The objective of the Needs Analysis was to determine the specific Study Areas where conventional Title 5 wastewater disposal systems are inadequate or conversely, where existing on-site wastewater disposal systems can remain and be effective for wastewater disposal.

A comprehensive two stage approach was utilized in the analysis consisting of: (1) a rating criteria matrix created to establish or eliminate a Study Area as a need area (community provided data); and (2) an evaluation of each Study Area based only on predominant soils classification, seasonally high groundwater level, and a combination of system age and lot size (disposal system constraint data). This type of data is specifically used when designing an on-site conventional Title 5 wastewater disposal system and is used in this study to confirm or eliminate a Study Area as a need area as determined in the First Stage Analytical Approach-Rating Criteria Matrix.

2. First Stage Analytical Approach - Rating Criteria Matrix

During the first stage, a rating criteria matrix was developed to evaluate the entire Island, which was broken down into eighteen Study Areas. The matrix consists of four levels of criteria that are assigned rating points. The information gathered in this first stage is the "Community" information or data on file within the community such as Board of Health Records (Title 5 reports, system repairs, system pumping records, percolation test information), Assessor records (lot size, age, density of properties, resale records, locations to wetlands and surface water bodies) and Water Department records (aquifer protection districts, proximity to wellheads, billing records for water use). The more comprehensive data that exists on file in the community, the more detailed the first stage analysis becomes and vice versa.

The highest rating is given to actual failures compiled from Board of Health records. The second highest rating is given to categorical failures based on current Title 5 regulations. The third highest rating is given to on-site systems that are at risk for failure/noncompliance, which are on-site systems that: (1) have severe groundwater limitations; (2) have severe soil limitations; (3) have on-site systems that were built before 1978; (4) are constructed on a lot size of one-half acre or less; and/or (5) have two or more septic tank pump-outs occurring within a calendar year. The fourth highest criteria is given to on-site systems that have health/water quality issues associated with on-site systems located: (1) in a Study Area with a density of on-site systems greater than two per acre; (2) within 100 feet of a surface water body; wetland or stream; (3) located within a 100 year flood plain; and (4) within a Zone II aquifer recharge area; and (5) located within either the Nantucket Harbor Watershed or Nantucket Harbor Watershed as defined by Chapter 99 of the Town By-Laws.

This “Community” data was compiled for each delineated Study Area and criteria points were established based on the sum of this information from the matrix. For each study area, the total criteria points were divided by the number of unsewered-developed lots. This in effect “normalized” the criteria points on a per lot basis and formed a rating number for each Study Area.

A “breakpoint” in the rating numbers is established from the tabulation of all of the Study Area “rating numbers”. The “breakpoint” for Nantucket is 7.33 based on the First Stage Analytical Approach-Rating Criteria Matrix.

The breakpoint was established by listing the corresponding rating number for each Study Area and calculating the difference between subsequent values. The largest differences were then studied. After reviewing this data, the 7.33 breakpoint value was selected because it best represented a threshold between specific conditions in Study Areas that are currently sewered, and thus warranted the construction of sewers in the past in Nantucket, and Study Areas that are currently unsewered.

All Study Areas with rating numbers that are greater than 7.33 were determined to be "Need Areas". The lower criteria point totals tend to reflect areas sustainable on current on-site systems whereas the highest criteria point totals tend to reflect areas that require a solution other than current on-site system. Refer to Table 1-1, Rating Criteria Points per Developed Lots. The table shows, the differences in the points per developed lots and that the breakpoint of 7.33 occurs in the Quidnet Study Area. As indicated in the preceding paragraph, review of the differences helps to set the breakpoint. The larger differences in points per developed lots represent a break in which one study area ranks significantly higher than the preceding study area listed. This break was determined to be significant in that, for example, Quidnet has more constraints in utilizing Conventional Title 5 Systems for on-site wastewater disposal than areas such as Miacomet or Surfside for example. The 7.33 break point was used to delineate the Study Areas into "No Need Areas" and "Need Areas". A second stage analytical approach was used to validate the break point assumption. Refer to Table 3D-1 from the Phase I Report.

3. Second Stage Analytical Approach - Soils, Groundwater and Age/Lot Evaluation

During the second stage of the analysis, each Study Area was evaluated based on predominant soil classification, groundwater levels, and a combination of system age and lot size or in total "disposal system constraint data". The three qualifying criteria are: (1) 50 percent or more of the lots within the Study Area meeting the age/lot size criteria (built before 1978 and a lot size of one-half acre or less); (2) 30 percent or more of the Study Area having severe soils limitations (hardpan, bedrock, slope, flooding and wetness); and (3) 20 percent or more of the Study Area having severe groundwater limitations (seasonally high water table at the surface to 2 feet deep). If two of these three criteria are met, then the Study Area is determined to be a need area.

**TABLE 1-1
TOWN OF NANTUCKET
CWMP/FEIR
RATING CRITERIA POINTS PER DEVELOPED LOT**

Study Area	Points Per Developed Lot	Difference In Points Per Developed Lot
Miacomet	1.990	---
Surfside	2.263	0.273
Tom Nevers Low-Density	3.238	0.974
Other	3.720	0.482
Shimmo	4.168	0.448
Tom Nevers High-Density	4.475	0.307
Siasconset	4.519	0.044
Town - WPZ	4.597	0.078
Town	5.077	0.480
Pocomo	5.111	0.034
Cisco	5.161	0.050
Monomoy	6.170	1.009
Quidnet	**7.333**	**1.163**
Somerset	7.404	0.070
Warren's Landing	8.088	0.685
Polpis	8.186	0.098
Madaket	8.400	0.214
Wauwinet	9.260	0.860

A thorough side by side comparison of the results of the above referenced two stage evaluation methods is made to determine: (1) if a given Study Area shows consistent need; and (2) areas where there is a conflict in need (e.g. areas that show a need in one evaluation approach and no need in the other), which are then further evaluated in order to identify the real need. This comparison identifies small Sub-Study Areas, which are evaluated based on the second stage criteria, which include soils classification, groundwater levels, and a combination of system age and lot size. Utilizing these two steps provides a comprehensive approach to determine not only areas that require something other than the current on-site system, but also those areas that can sustain with their current on-site systems as a long-term wastewater solution.

On-Site Wastewater Disposal System Age

On-site wastewater disposal systems built before 1978 have a very high likelihood of failure due to the lack of design and construction controls placed on these systems prior to this date. If a developed lot had an on-site wastewater disposal system that was built before 1978, the system today would most likely fail a current Title 5 inspection. In 1978, Title 5 Regulations were promulgated by DEP and the local Boards of Health were required to enforce these regulations. The significance of this date is that prior to 1978, there were rules pertaining to the design and construction monitoring of on-site wastewater disposal systems, but these requirements were significantly less stringent and enforcement by the State Department of Public Health was ineffective.

Lot Size

Lot size will have a direct affect on whether or not a failed on-site wastewater disposal system can be repaired to meet current Title 5 criteria. It is a reasonable assumption that under less than ideal soil and groundwater conditions, all lots of one-half acre or less in an area would, as a minimum, require a variance to Title 5 in order to repair the on-site wastewater disposal system.

To better describe how lot size will affect the ability to repair an existing failed on-site wastewater disposal system, consider the following scenario: a one-half acre lot with typical dwelling, property line and structure setbacks along with Title 5 setbacks is shown in Figure 1-1. If the soils and groundwater levels are not problematic there is about 9,150 square feet available for a soil absorption system. A typical soil absorption system servicing a four-bedroom single-family residence generating 440 gallon per day of wastewater being disposed into the ground with a percolation rate of 10 minutes per inch will require about 2,500 square feet. If an on-site wastewater disposal system under the same general conditions has to be mounded, due to high groundwater, the land area required to build this system is about 4,400 square feet.

- If 30 percent of the one-half acre lot has severe soil limitations (hardpan, bedrock, etc.) the useable land for a new on-site system is reduced to less than 2,500 square feet.

- If 20 percent of the one-half acre lot has severe groundwater limitations (seasonally high groundwater level at the surface to 2 feet below grade) the useable land for a new on-site system is reduced to less than 4,400 square feet.

Insert Figure 1-1

Combination Age and Lot Size Criteria

If 50 percent or more of the properties within a study area have an on-site system that was built before 1978 and a lot of one-half acre or less, then the age/lot size criteria has been met. The percentage was chosen as it represents that the majority of the study area has a small lot size and an outdated on-site wastewater disposal system.

Severe Soils Criteria

If 30 percent or more of the soils within a study area classified as having severe limitations (hardpan, bedrock, slope, high permeability sands, flooding and wetness) the severe soils criteria has been met. The percentage represents the maximum amount of severe soils that can be present on a lot and still construct a conventional Title 5 system. Soil types were obtained from the Soil Survey Report by the U.S. Department of Agriculture.

Severe Groundwater Criteria

If 20 percent or more of a study area is classified as having a "moderately shallow" to "shallow" (high water table at the surface to 2 feet deep) seasonally high groundwater level the severe groundwater criteria has been met. The percentage represents the maximum amount of severe groundwater that can be present on a lot and still construct a conventional Title 5 system. High groundwater levels were obtained from the Soil Survey Report by the U.S. Department of Agriculture.

Need Determination

As per the Second Stage Analytical Approach, if two of the three criteria are met then the study area qualifies as a "Need Area". As previously discussed, the three criteria are: (1) having 50 percent or more of the properties within the study area meeting the age/lot size criteria (built before 1978 and a lot size of one-half acre or less); (2) having 30 percent or more of the study area with severe soils limitations (hardpan, bedrock, slope, high permeability sands, flooding and wetness); and (3) having 20 percent or more of the study area with severe groundwater limitations (seasonally high water table at the surface to 2 feet below grade).

If this hypothetical one-half acre lot had an on-site wastewater disposal system that failed and the property was developed before 1978 and the lot has either 30 percent severe soils or 20 percent high groundwater, the existing system could not be repaired using a conventional Title 5 system.

The options for a solution for this system would be either: (1) allowing variances to the conventional Title 5 system; (2) on-site innovative-alternative systems;(3) communal wastewater treatment and disposal; (4) local wastewater treatment and (5) regional wastewater treatment. Of these alternatives, the recommended solution for each study area with wastewater disposal needs will be presented in Phase II of the CWMP, based on comprehensive technical, environmental, and financial considerations.

Refer to Table 1-2 for a summary of the results from the rating criteria matrix for the entire Town from the Phase I Report on the next few pages. This shows all the criteria used for evaluation and exactly how it applied to each of the eighteen Study Areas in Town.

4. Results of Needs Analysis

The final results are summarized below for each study area.

Madaket

This study area is comprised of 394 acres of which approximately 232 acres are currently developed. There are 435 developed lots located in this study area. The average age of the residential units is 30 years. This study area is about 50 percent developed. About 22 percent of the soils in this study area are classified as severe (hardpan, bedrock, slope, high permeability sands, flooding and wetness) and about 30 percent of this study area is classified as having moderate to severe groundwater levels (i.e. water table varies from the ground surface to two feet below grade). Approximately 435 systems fall within 3,600 feet of Madaket Harbor.

Between 1972 and 1999, there were 105 reported on-site wastewater disposal system repairs or upgrades in this study area. Since the revised Title 5 regulations came into effect on March 31, 1995, the failure rate in this study area has been approximately 44 percent, based on 70 resales.

TABLE 1-2
TOWN OF NANTUCKET
CWMP/FEIR
RATING CRITERIA

TABLE 1-2 (cont)
TOWN OF NANTUCKET
CWMP/FEIR
RATING CRITERIA

TABLE 1-2 (cont)
TOWN OF NANTUCKET
CWMP/FEIR
RATING CRITERIA

This study area has a criteria point rating of 8.40 per developed lot, which is above the threshold of 7.33. The properties within this study area have the following characteristics: approximately 46 percent were developed before 1978 and have a lot size of one-half acre or less; approximately 22 percent have poor soils; and approximately 30 percent have high groundwater.

Conventional Title 5 septic systems are not the recommended long-term wastewater disposal solution for this study area. On-site innovative alternative systems, local or satellite wastewater disposal systems are all presently viable alternatives for effectively addressing the wastewater disposal needs in this study area. Of these alternatives, the recommended solution for this study area will be presented in Phase II of the CWMP/EIR, based on comprehensive technical, environmental, and financial considerations.

Warren's Landing

This study area is comprised of 49 acres of which approximately 26 acres are currently developed. There are 68 developed lots located in this study area. The average age of the residential units is 10 years. This study area is about 69 percent developed. Approximately 53 percent of the soils in this study area are classified as severe (hardpan, bedrock, slope, high permeability sands, flooding and wetness) and 221 percent of this study area is classified as having moderate to severe groundwater levels (i.e. seasonally high water table varies from the ground surface to two feet below grade). Approximately 34 systems fall within 3,600 feet of Madaket Harbor.

Between 1973 and 1999, there were 6 reported on-site wastewater disposal system repairs or upgrades in this study area. Since the revised Title 5 regulations came into effect on March 31, 1995, the failure rate in this study area has been approximately 21 percent, based on 19 resales.

This study area has a criteria point rating of 8.08 per developed lot, which is above the threshold of 7.33. The properties within this study area have the following characteristics: no properties were developed before 1978 and had a lot size of one-half acre or less; approximately 53 percent have poor soils; and approximately 21 percent have high groundwater.

Conventional Title 5 septic systems are not the recommended long-term wastewater disposal solution for this study area. On-site innovative alternative systems, local or satellite wastewater disposal systems are all presently viable alternatives for effectively addressing the wastewater disposal needs in this study area. Of these alternatives, the recommended solution for this study area will be presented in Phase II of the CWMP/EIR, based on comprehensive technical, environmental, and financial considerations.

Cisco

This study area is comprised of 355 acres of which approximately 143 acres are currently developed. There are 143 developed lots located in this study area. The average age of the residential units is 19 years. This study area is about 70 percent developed. About 50 percent of the soils in this study area are classified as severe (hardpan, bedrock, slope, high permeability sands, flooding and wetness) and about 8 percent of this study area is classified as having moderate to severe groundwater levels (i.e. water table varies from the ground surface to two feet below grade).

Between 1972 and 1999, there were 18 reported on-site wastewater disposal system repairs or upgrades in this study area. Since the revised Title 5 regulations came into effect on March 31, 1995, the failure rate in this study area has been approximately 30 percent, based on 27 unsewered resales.

This study area has a criteria point rating of 5.16 per developed lot, which is below the threshold of 7.33. The properties within this study area have the following characteristics: approximately 9 percent were developed before 1978 and have a lot size of one-half acre or less; approximately 50 percent have poor soils; and approximately 8 percent have high groundwater.

Conventional Title 5 septic systems are the recommended long-term wastewater disposal solution for this study area. This study area should be maintained in accordance with the Town's Septage Management Plan.

Somerset

This study area is comprised of 151 acres of which approximately 103 acres are currently developed. There are 161 developed lots located in this study area. The average age of the residential units is 12 years. This study area is about 78 percent developed. About 64 percent of the soils in this study area are classified as severe (hardpan, bedrock, slope, high permeability sands, flooding and wetness) and about 5 percent of this study area is classified as having moderate to severe groundwater levels (i.e. water table varies from the ground surface to two feet below grade).

Between 1972 and 1999, there were 29 reported on-site wastewater disposal system repairs or upgrades in this study area. Since the revised Title 5 regulations came into effect on March 31, 1995, the failure rate in this study area has been approximately 73 percent, based on 30 resales.

This study area has a criteria point rating of 7.40 per developed lot, which is above the threshold of 7.33. The properties within this study area have the following characteristics: approximately 1 percent were developed before 1978 and have a lot size of one-half acre or less; approximately 64 percent have poor soils; and approximately 5 percent have high groundwater.

Conventional Title 5 septic systems are not the recommended long-term wastewater disposal solution for this study area. On-site innovative alternative systems, local or satellite wastewater disposal systems are all presently viable alternatives for effectively addressing the wastewater disposal needs in this study area. Of these alternatives, the recommended solution for this study area will be presented in Phase II of the CWMP/EIR, based on comprehensive technical, environmental, and financial considerations.

Miacomet

This study area is comprised of 296 acres of which approximately 197 acres are currently developed. There are 101 developed lots located in this study area. The average age of the residential units is 14 years. This study area is about 79 percent developed. About 51 percent of the soils in this study area are classified as severe (hardpan, bedrock, slope, high permeability sands, flooding and wetness) and about 3 percent of this study area is classified as having moderate to severe groundwater levels (i.e. water table varies from the ground surface to two feet below grade).

Between 1972 and 1999, there were 14 reported on-site wastewater disposal system repairs or upgrades in this study area. Since the revised Title 5 regulations came into effect on March 31, 1995, the failure rate in this study area has been approximately 53 percent, based on 15 resales.

This study area has a criteria point rating of 1.99 per developed lot, which is below the threshold of 7.33. The properties within this study area have the following characteristics: approximately 1 percent were developed before 1978 and have a lot size of one-half acre or less; approximately 51 percent have poor soils; and approximately 3 percent have high groundwater.

Conventional Title 5 septic systems are the recommended long-term wastewater disposal solution for this study area. This study area should be maintained in accordance with the Town's Septage Management Plan.

Surfside

This study area is comprised of 685 acres of which approximately 363 acres are currently developed. There are 281 developed lots located in this study area. The average age of the residential units is 19 years. This study area is about 67 percent developed. About 16 percent of the soils in this study area are classified as severe (hardpan, bedrock, slope, high permeability sands, flooding and wetness) and about 7 percent of this study area is classified as having moderate to severe groundwater levels (i.e. water table varies from the ground surface to two feet below grade).

Between 1972 and 1999, there were 48 reported on-site wastewater disposal system repairs or upgrades in this study area. Since the revised Title 5 regulations came into effect on March 31, 1995, the failure rate in this study area has been approximately 48 percent, based on 44 resales.

This study area has a criteria point rating of 2.26 per developed lot, which is below the threshold of 7.33. The properties within this study area have the following characteristics: approximately 9 percent were developed before 1978 and have a lot size of one-half acre or less; approximately 16 percent have poor soils; and approximately 7 percent have high groundwater.

Conventional Title 5 septic systems are the recommended long-term wastewater disposal solution for this study area. This study area should be maintained in accordance with the Town's Septage Management Plan.

Tom Nevers – High Density

This study area is comprised of 129 acres of which approximately 63 acres are currently developed. There are 255 developed lots located in this study area. The average age of the residential units is 8 years. This study area is about 73 percent developed. About 47 percent of the soils in this study area are classified as severe (hardpan, bedrock, slope, high permeability sands, flooding and wetness) and about 21 percent of this study area is classified as having moderate to severe groundwater levels (i.e. water table varies from the ground surface to two feet below grade).

Between 1972 and 1999, there were 2 reported on-site wastewater disposal system repairs or upgrades in this study area. Since the revised Title 5 regulations came into effect on March 31, 1995, the failure rate in this study area has been approximately 8 percent, based on 26 resales.

This study area has a criteria point rating of 4.48 per developed lot, which is below the threshold of 7.33. The properties within this study area have the following characteristics: approximately 1 percent were developed before 1978 and have a lot size of one-half acre or less; approximately 47 percent have poor soils; and approximately 21 percent have high groundwater.

Conventional Title 5 septic systems are the recommended long-term wastewater disposal solution for this study area. This study area should be maintained in accordance with the Town's Septage Management Plan.

Tom Nevers – Low Density

This study area is comprised of 653 acres of which approximately 374 acres are currently developed. There are 122 developed lots located in this study area. The average age of the residential units is 15 years. This study area is about 63percent developed. About 44 percent of the soils in this study area are classified as severe (hardpan, bedrock, slope, high permeability sands, flooding and wetness) and about 5 percent of this study area is classified as having moderate to severe groundwater levels (i.e. water table varies from the ground surface to two feet below grade).

Between 1972 and 1999, there were 28 reported on-site wastewater disposal system repairs or upgrades in this study area. Since the revised Title 5 regulations came into effect on March 31, 1995, the failure rate in this study area has been approximately 27 percent, based on 48 resales.

This study area has a criteria point rating of 3.24 per developed lot, which is below the threshold of 7.33. The properties within this study area have the following characteristics: approximately 3 percent were developed before 1978 and have a lot size of one-half acre or less; approximately 44 percent have poor soils; and approximately 5 percent have high groundwater.

Conventional Title 5 septic systems are the recommended long-term wastewater disposal solution for this study area. This study area should be maintained in accordance with the Town's Septage Management Plan.

Siasconset

This study area is comprised of 1,012 acres of which approximately 349 acres are currently developed. There are 664 developed lots located in this study area of which 127 are currently unsewered. The average age of the residential units is 56 years. This study area is about 63 percent developed with approximately 81 percent of the developed lots connected to the existing wastewater collection system. About 47 percent of the soils in this study area are classified as severe (hardpan, bedrock, slope, high permeability sands, flooding and wetness) and about 29 percent of this study area is classified as having moderate to severe groundwater levels (i.e. water table varies from the ground surface to two feet below grade).

Between 1972 and 1999, there were 18 reported on-site wastewater disposal system repairs or upgrades in this study area. Since the revised Title 5 regulations came into effect on March 31, 1995, the failure rate in this study area has been approximately 11 percent, based on 27 resales of unsewered developed lots.

This study area has a criteria point rating of 4.52 per developed lot, which is below the threshold of 7.33. The properties within this study area have the following characteristics: approximately 53 percent were developed before 1978 and have a lot size of one-half acre or less; approximately 47 percent have poor soils; and approximately 29 percent have high groundwater.

Conventional Title 5 septic systems are not the recommended long-term wastewater disposal solution for this study area since a majority of the study area is currently provided with wastewater collection, treatment and disposal.

Quidnet

This study area is comprised of 68 acres of which approximately 45 acres are currently developed. There are 45 developed lots located in this study area. The average age of the residential units is 47 years. This study area is about 58 percent developed. About 28 percent of the soils in this study area are classified as severe (hardpan, bedrock, slope, high permeability sands, flooding and wetness) and about 32 percent of this study area is classified as having moderate to severe groundwater levels (i.e. seasonally high water table varies from the ground surface to two feet below grade).

Between 1972 and 1999, there were 20 reported on-site wastewater disposal system upgrades or repairs in this study area. Since the revised Title 5 regulations came into effect on March 31, 1995, the failure rate in this study area has been approximately 78 percent, based on 9 resales.

This study area has a criteria point rating of 7.33 per developed lot, which is at he threshold of 7.33. The properties within this study area have the following characteristics: approximately 36 percent were developed before 1978 and have a lot size of one-half acre or less; approximately 28 percent have poor soils; and approximately 32 percent have high groundwater.

Conventional Title 5 septic systems are not the recommended long-term wastewater disposal solution for this study area. On-site innovative alternative systems, local or satellite wastewater disposal systems are all presently viable alternatives for effectively addressing the wastewater disposal needs in this study area. Of these alternatives, the recommended solution for this study area will be presented after the results of the Massachusetts Estuary Project is completed and will be based on comprehensive technical, environmental, and financial considerations.

Wauwinet

This study area is comprised of 61 acres of which approximately 51 acres are currently developed. There are 50 developed lots located in this study area. The average age of the residential units is 46 years. This study area is about 74 percent developed. About 15 percent of the soils in this study area are classified as severe (hardpan, bedrock, slope, high permeability sands, flooding and wetness) and about 47 percent of this study area is classified as having moderate to severe groundwater levels (i.e. seasonally high water table varies from the ground surface to two feet below grade). Approximately 50 systems are within the Harbor Watershed Line.

Between 1972 and 1999, there were 14 reported on-site wastewater disposal system repairs or upgrades in this study area. Since the revised Title 5 Regulations came into effect on March 31, 1995, the failure rate in this study area is 100 percent, based on 3 resales.

This study area has a criteria point rating of 9.26 per developed lot, which is above the threshold of 7.33. The properties within this study area have the following characteristics: approximately 10 percent were developed before 1978 and have a lot size of one-half acre or less; approximately 15 percent have poor soils; and approximately 47 percent have high groundwater.

Conventional Title 5 septic systems are not the recommended long-term wastewater disposal solution for this study area. On-site innovative alternative systems, local or satellite wastewater disposal systems are all presently viable alternatives for effectively addressing the wastewater disposal needs in this study area. Of these alternatives, the recommended solution for this study area will be presented after the results of the Massachusetts Estuary Project is completed and will be based on comprehensive technical, environmental, and financial considerations.

Pocomo

This study area is comprised of 457 acres of which approximately 297 acres are currently developed. There are 81 developed lots located in this study area. The average age of the residential units is 24 years. This study area is about 58 percent developed. About 36 percent of the soils in this study area are classified as severe (hardpan, bedrock, slope, high permeability sands, flooding and wetness) and about 35 percent of this study area is classified as having moderate to severe groundwater levels (i.e. water table varies from the ground surface to two feet below grade). Approximately 81 systems are within the Harbor Watershed Line.

Between 1972 and 1999, there were 15 reported on-site wastewater disposal system repairs or upgrades in this study area. Since the revised Title 5 regulations came into effect on March 31, 1995, the failure rate in this study area has been approximately 55 percent, based on 11 resales.

This study area has a criteria point rating of 5.11 per developed lot, which is below the threshold of 7.33. The properties within this study area have the following characteristics: approximately 6 percent were developed before 1978 and have a lot size of one-half acre or less; approximately 36 percent have poor soils; and approximately 35 percent have high groundwater.

Conventional Title 5 septic systems are not the recommended long-term wastewater disposal solution for this study area since the study area abuts the Town Harbor and is entirely located within the Harbor Watershed Area. On-site innovative alternative systems, local or satellite wastewater disposal systems are all presently viable alternatives for effectively addressing the wastewater disposal needs in this study area. Of these alternatives, the recommended solution for this study area will be presented after the results of the Massachusetts Estuary Project is completed and will be based on comprehensive technical, environmental, and financial considerations.

Polpis

This study area is comprised of 583 acres of which approximately 395 acres are currently developed. There are 59 developed lots located in this study area. The average age of the residential units is 44 years. This study area is about 59 percent developed. About 64 percent of the soils in this study area are classified as severe (hardpan, bedrock, slope, high permeability sands, flooding and wetness) and about 56 percent of this study area is classified as having moderate to severe groundwater levels (i.e. water table varies from the ground surface to two feet below grade). Approximately 59 systems are within the Harbor Watershed Line.

Between 1972 and 1999, there were 22 reported on-site wastewater disposal system repairs or upgrades in this study area. Since the revised Title 5 regulations came into effect on March 31, 1995, the failure rate in this study area is 100 percent, based on 10 resales.

This study area has a criteria point rating of 8.19 per developed lot, which is above the threshold of 7.33. The properties within this study area have the following characteristics: approximately 15 percent were developed before 1978 and have a lot size of one-half acre or less; approximately 64 percent have poor soils; and approximately 56 percent have high groundwater.

Conventional Title 5 septic systems are not the recommended long-term wastewater disposal solution for this study area. On-site innovative alternative systems, local or satellite wastewater disposal systems are all presently viable alternatives for effectively addressing the wastewater disposal needs in this study area. Of these alternatives, the recommended solution for this study area will be presented after the results of the Massachusetts Estuary Project is completed and will be based on comprehensive technical, environmental, and financial considerations.

Town

This study area is comprised of 1,922 acres of which approximately 1,333 acres are currently developed. There are 3,943 developed lots located in this study area of which 890 are currently unsewered. The average age of the residential units is 64 years. This study area is about 83 percent developed with approximately 77 percent of the developed lots connected to the existing wastewater collection system. About 56 percent of the soils in this study area are classified as severe (hardpan, bedrock, slope, high permeability sands, flooding and wetness) and about 22 percent of this study area is classified as having moderate to severe groundwater levels (i.e. water table varies from the ground surface to two feet below grade). Approximately 1972 systems are within the Harbor Watershed Line.

Between 1972 and 1999, there were 142 reported on-site wastewater disposal system repairs or upgrades in this study area. Since the revised Title 5 regulations came into effect on March 31, 1995, the failure rate in this study area has been approximately 40 percent, based on 108 resales of unsewered developed lots.

This study area has a criteria point rating of 5.08 per developed lot, which is below the threshold of 7.33. The properties within this study area have the following characteristics: approximately 47 percent were developed before 1978 and have a lot size of one-half acre or less; approximately 56 percent have poor soils; and approximately 22 percent have high groundwater.

Conventional Title 5 septic systems are not the recommended long-term wastewater disposal solution for this study area since a majority of the study area is currently provided with wastewater collection, treatment and disposal.

Town - WPZ

This study area is comprised of 744 acres of which approximately 313 acres are currently developed. This area encompasses the Wellhead Protection Overlay Zone. There are 524 developed lots located in this study area of which 315 are currently unsewered. The average age of the residential units is 15 years. This study area is about 71 percent developed with approximately 40 percent of the developed lots connected to the existing wastewater collection system. About 43 percent of the soils in this study area are classified as severe (hardpan, bedrock, slope, high permeability sands, flooding and wetness) and about 1 percent of this study area is classified as having moderate to severe groundwater levels (i.e. water table varies from the ground surface to two feet below grade).

Between 1972 and 1999, there were 47 reported on-site wastewater disposal system repairs or upgrades in this study area. Since the revised Title 5 regulations came into effect on March 31, 1995, the failure rate in this study area has been approximately 62 percent, based on 37 resales of unsewered developed lots.

This study area has a criteria point rating of 4.60 per developed lot, which is below the threshold of 7.33. The properties within this study area have the following characteristics: approximately 6 percent were developed before 1978 and have a lot size of one-half acre or less; approximately 43 percent have poor soils; and approximately 1 percent have high groundwater.

Conventional Title 5 septic systems will be considered as the long-term wastewater disposal solution for portions of this study area as this study area is located within the Wellhead Protection Overlay Zone and approximately 40 percent is of the study area is currently provided with wastewater collection, treatment and disposal. On-site innovative alternative systems, local or satellite wastewater disposal systems are all presently viable alternatives for effectively addressing the wastewater disposal needs in this study area. Of these alternatives, the recommended solution for this study area will be presented in Phase II of the CWMP/EIR, based on comprehensive technical, environmental, and financial considerations. For those areas with on-site wastewater disposal systems, they will continue to be the recommended long-term solution for this study area. This study area should be maintained in accordance with the Town’s Septage Management Plan.

Shimmo

This study area is comprised of 881 acres of which approximately 380 acres are currently developed. There are 137 developed lots located in this study area. The average age of the residential units is 21 years. This study area is about 48 percent developed. About 26 percent of the soils in this study area are classified as severe (hardpan, bedrock, slope, high permeability sands, flooding and wetness) and about 19 percent of this study area is classified as having moderate to severe groundwater levels (i.e. seasonally high water table varies from the ground surface to two feet below grade). Approximately 103 systems are located within the Harbor Watershed Line.

Between 1972 and 1999, there were 26 reported on-site wastewater disposal system repairs or upgrades in this study area. Since the revised Title 5 regulations came into effect on March 31, 1995, the failure rate in this study area has been approximately 43 percent, based on 21 resales.

This study area has a criteria point rating of 4.17 per developed lot, which is below the threshold of 7.33. The properties within this study area have the following characteristics: approximately 1 percent were developed before 1978 and have a lot size of one-half acre or less; approximately 26 percent have poor soils; and approximately 19 percent have high groundwater.

Conventional Title 5 septic systems are not the recommended long-term wastewater disposal solution for this study area since the study area abuts the Town Harbor and approximately 75 percent is located within the Harbor Watershed Area. On-site innovative alternative systems, local or satellite wastewater disposal systems are all presently viable alternatives for effectively addressing the wastewater disposal needs in this study area. Of these alternatives, the recommended solution for this study area will be presented in Phase II of the CWMP/EIR, based on comprehensive technical, environmental, and financial considerations.

Monomoy

This study area is comprised of 276 acres of which approximately 218 acres are currently developed. There are 184 developed lots located in this study area of which 178 are currently unsewered. The average age of the residential units is 29 years. This study area is about 70 percent developed with approximately 3 percent of the developed lots connected to the existing wastewater collection system. About 54 percent of the soils in this study area are classified as severe (hardpan, bedrock, slope, high permeability sands, flooding and wetness) and about 16 percent of this study area is classified as having moderate to severe groundwater levels (i.e. seasonally high water table varies from the ground surface to two feet below grade). Approximately 184 systems are located within the Harbor Watershed Line.

Between 1972 and 1999, there were 47 reported on-site wastewater disposal system repairs or upgrades in this study area. Since the revised Title 5 regulations came into effect on March 31, 1995, the failure rate in this study area has been approximately 90 percent, based on 19 resales of unsewered developed lots.

This study area has a criteria point rating of 6.17 per developed lot, which is below the threshold of 7.33. The properties within this study area have the following characteristics: approximately 14 percent were developed before 1978 and have a lot size of one-half acre or less; approximately 54 percent have poor soils; and approximately 16 percent have high groundwater.

Conventional Title 5 septic systems are not the recommended long-term wastewater disposal solution for this study area since the study area abuts the Town Harbor and is entirely located within the Harbor Watershed Area. On-site innovative alternative systems, local or satellite wastewater disposal systems are all presently viable alternatives for effectively addressing the wastewater disposal needs in this study area. Of these alternatives, the recommended solution for this study area will be presented in Phase II of the CWMP/EIR, based on comprehensive technical, environmental, and financial considerations.

Remaining Island

This study area is comprised of 21,863 acres of which approximately 5,422 acres are currently developed. There are 818 developed lots located in this study area of which 812 are currently unsewered. The average age of the residential units is 26 years. This study area is about 32 percent developed with approximately 1 percent of the developed lots connected to the existing wastewater collection system. About 35 percent of the soils in this study area are classified as severe (hardpan, bedrock, slope, high permeability sands, flooding and wetness) and about 24 percent of this study area is classified as having moderate to severe groundwater levels (i.e. seasonally high water table varies from the ground surface to two feet below grade). Approximately 161 systems are located within the Harbor Watershed Line.

Between 1972 and 1999, there were 170 reported on-site wastewater disposal system repairs or upgrades in this study area. Since the revised Title 5 regulations came into effect on March 31, 1995, the failure rate in this study area has been approximately 53 percent, based on 114 resales of unsewered developed lots.

This study area has a criteria point rating of 3.72 per developed lot, which is below the threshold of 7.33. The properties within this study area have the following characteristics: approximately 5 percent were developed before 1978 and have a lot size of one-half acre or less; approximately 35 percent have poor soils; and approximately 24 percent have high groundwater.

Conventional Title 5 septic systems are the recommended long-term wastewater disposal solution for this study area. This study area should be maintained in accordance with the Town’s Septage Management Plan.

Of the eighteen studies areas, seven study areas have been identified as having a need or are currently located within the existing service are, while the remaining study areas can be maintained in accordance with the Town’s Septage Management Plan. Refer to Table 1-3 for a summary of the Needs Analysis.

B. WASTEWATER FLOW UPDATE

In the Phase I Report, wastewater flows were estimated for each study area for both the initial and design years. The estimates are based on the number of developed lots and undeveloped parcels within each study area based on the Assessor’s information. The design wastewater flow for each study area was calculated from the undeveloped parcel and acreage data to determine the design number of developed lots.

TABLE 1-3
TOWN OF NANTUCKET
CWMP/FEIR
STUDY AREA LONG TERM WASTEWATER DISPOSAL OPTION

	Long Term Wastewater Disposal Option	
Study Area	On-site Innovative Alternative Systems, Local or Satellite WWTF	Septage Management Plan
Miacomet		X
Surfside		X
Tom Nevers Low-Density		X
Other		X
Shimmo	X	
Tom Nevers High-Density		X
Siasconset	X	
Town - WPZ		X
Town	X	
Pocomo		X
Cisco		X
Monomoy	X	
Quidnet		X
Somerset	X	
Warren's Landing	X	
Polpis		X
Madaket	X	
Wauwinet		X

The wastewater flow estimates have been expanded to include future flows from second dwellings. Nantucket bylaws allow for a second dwelling to be built on buildable lots. The wastewater flow estimates assumes that it is possible to build second dwellings on two thirds of the current developed and undeveloped buildable lots. Refer to Table 1-4 for a summary of the updated flows for each Need Area.

TABLE 1-4
TOWN OF NANTUCKET
CWMP/FEIR
ESTIMATED WASTEWATER FLOWS BY STUDY AREA

Study Area	Design Flows without Second Dwellings (gpd)		Design Flows with Second Dwellings (gpd)	
	Winter	Summer	Winter	Summer
Madaket	101,715	175,730	169,516	293,007
Warrens Landing	16,465	28,480	27,497	47,562
Somerset	38,225	65,700	63,139	108,794
Siasconset	163,340	280,230	268,945	462,899
Quidnet	9,620	16,640	16,065	27,789
Wauwinet	11,250	19,250	18,439	31,685
Pocomo	20,980	36,185	34,862	60,198
Polpis	15,245	26,265	25,285	43,631
Town	883,710	1,470,245	1,378,766	2,326,559
Town-WPZ	147,920	237,115	215,845	354,606
Shimmo	34,300	59,225	57,107	98,675
Monomoy	42,295	72,740	69,936	120,551
Total Design Flows	1,485,065	2,487,805	2,345,402	3,975,955

Note:

1. Estimated Wastewater Flows do not include an allowance for infiltration/inflow.

The estimated design flows were then assigned to existing water treatment facilities or future wastewater treatment facilities. The assigned flows were used to as design flows for the evaluation of short listed alternatives. Refer to Table 1-5 for a summary of the updated flows by wastewater treatment facility. The design flows for Quidnet, Wauminet, Pocomo, and Polpis will be managed with a Septage Management Plan.

TABLE 1-5
TOWN OF NANTUCKET
CWMP/FEIR
ESTIMATED WASTEWATER FLOWS BY
WASTEWATER TREATMENT FACILITY

Study Area	Flow – Design Summer (gpd)	Wastewater Treatment Facility Flow – Design Summer (gpd)		
		Surfside	Siasconset	Madaket
Madaket	293,007			293,007
Warrens Landing	47,562			47,562
Somerset	108,794	108,794		
Siasconset	210,175		210,175	
Town	2,326,559	2,326,559		
Town-WPZ	354,606	354,606		
Shimmo	98,675	98,675		
Monomoy	120,551	120,551		
Total Design Flows		3,009,185	210,175	340,568

Notes:

1. The estimated wastewater flow for Siasconset has been adjusted based on the approved Facility Plan dated December 1997 which calculated the future summer season sewered population being 75 percent of the future summer season total population.
2. Estimated Wastewater Flows do not include an allowance for infiltration/inflow.

C. DISPOSAL SITE ALTERNATIVES

The CWMP/FEIR Phase III Document in its entirety addresses this topic.

D. WATER SUPPLY

Section 6 of the CWMP/FEIR Phase III Document addresses this topic.

E. PLANNING FOR GROWTH (EXECUTIVE ORDER #385)

The CWMP/FEIR Phase III Document in its entirety addresses this topic.

Section 2.0

Identify and Discuss Alternatives for Wastewater Disposal

2.0 IDENTIFY AND DISCUSS ALTERNATIVES FOR WASTEWATER DISPOSAL

A. INTRODUCTION

A variety of wastewater alternatives were investigated during the Phase III CWMP/FEIR to determine the appropriate wastewater facilities that will meet the needs of Nantucket. The wastewater alternatives that were investigated include: (a) the continued use of existing on-site wastewater disposal systems; (b) replacement of existing wastewater disposal systems with Title 5 systems; (c) replacement of existing wastewater disposal systems with on-site innovative/alternative options; (d) replacement of existing wastewater disposal systems with cluster systems consisting of a pressure system and communal subsurface disposal; and (e) replacement of existing wastewater disposal systems with a conventional sewer collection system, either: (1) connection into the existing collection system; (2) gravity sewers and pump station, (3) pressure sewers and grinder pumps, or (4) a combination thereof. Each wastewater alternative was evaluated based on environmental and technical design criteria and on site-specific data such as subsurface conditions, topography, and existing septic system performance. The CWMP/FEIR Phase III document evaluated the environmental, technical design and institutional cost associated with each alternative and recommends the appropriate solution to the wastewater disposal problems for the Town of Nantucket in order to reach a long-term solution to the wastewater needs of the Island.

B. OPTIMIZE OPERATION AND MAINTENANCE OF EXISTING ON-SITE SYSTEMS

One alternative considered is optimizing the performance of the existing on-site wastewater disposal systems, which includes optimizing septage management plans, maintenance, and repair and upgrade of current on-site systems. If this alternative were pursued Island-wide, all developed lots currently not in a sewer service area, would remain dependent on their existing on-site wastewater disposal systems. As documented in the Phase I CWMP/EIR Document, there are substantial documented failures and disposal systems with eminent problems in Nantucket. This alternative looked at each individual Study Area identified in the Phase I Document and evaluate the potential for remaining on the current on-site wastewater disposal systems under a Septage Management Plan. Assessments of various levels of compliance, including maximum feasible compliance will be made. The potential effects on surface water quality, coordinating efforts with the State Estuary Project in the Nantucket Harbor, Sesachacha Pond and Madaket Harbor areas, will be discussed. Additional assessments were made on groundwater quality and the protection of the sole source aquifer, growth in the planning area as it relates to Executive

Order 385, land use limitations and socioeconomic factors such as residential and industrial development and public health issues. Economic and legal impacts to the Town and all regulatory requirements of the State Department of Environmental Protection (DEP) and the Federal Environmental Protection Agency (EPA) were considered and discussed.

The Town of Nantucket has recently embarked on a study to develop a Septage Management Plan (SMP) for the Island. The SMP will be completed in coordination with the final recommendations of this Phase III CWMP/FEIR document in order to provide a long-term solution to those areas on Island evaluated and recommended for this alternative.

1. Repair / Upgrade Existing On-Site Systems

One alternative considered for the areas of wastewater disposal need on the Island is continued use of existing systems with emphasis on optimizing the performance of the existing on-site wastewater disposal systems. This includes optimizing septage management plans, maintenance, and repair and upgrade of on-site systems.

Failing on-site wastewater disposal systems contribute to the degradation of water quality of groundwater, wetlands and surface water. The surface waters bordered by areas of wastewater disposal need on the Island are: Tom Nevers Pond, Sesachacha Pond, The Creeks, Miacomet Pond, Shimmo Creek, Hither Creek, Long Pond, No Bottom Pond, and Reed Pond. The swamps and/or wetlands bordered by areas of wastewater disposal need are: Pocomo Meadow, Squam Swamp, Rolgers Marsh, Millbrook Swamp, Brunt Swamp, and Madaket Ditch. The harbors bordered by areas of wastewater disposal need on the Island are: Nantucket Harbor, Madaket Harbor, and Polpis Harbor. These water bodies and water ways are located adjacent, within, and downstream of the areas of wastewater disposal need and are threatened by existing on-site wastewater disposal systems (both properly operating as well as malfunctioning systems depending on the soils present and groundwater table) which will eventually contribute to water quality degradation due to contamination of groundwater.

As time passes, the non-conforming on-site wastewater disposal systems that do not meet current Title 5 rules and regulations will become less adequate and will contribute to the degradation of groundwater, wetlands and surface water. These sub-standard on-site wastewater disposal systems combined with soils with severe limitations for subsurface sewage disposal and high groundwater levels are a potential health hazard. With increased system age combined with these environmental issues, it is expected that property owners will experience future operating nuisances and eventually failures. If the water quality of surface water bodies continues to decline, Nantucket will potentially lose a very important recreational resource. Declining water quality of Miacomet Pond, Hither Creek, Long Pond, Nantucket Harbor, Madaket Harbor, and Polpis Harbor may reach such unacceptable levels that swimming could be prohibited.

As more on-site wastewater disposal systems fail, individual property owners will be required to upgrade their systems to a conventional or innovative/alternative Title 5 system. If this cannot be accomplished due to the physical site conditions, a tight tank would be required and would only be approved by the DEP to eliminate a failed system. The cost of frequently pumping these tight tanks will be a financial burden for the property owners. Property owners would not be able to expand their homes and/or even fully use their existing facilities. In this scenario, property values would decline.

With the increased potential of the degradation of both the water quality in the surface water bodies and the drinking water supply from the sole source aquifer, Nantucket is obligated to provide for acceptable wastewater disposal for the areas of need. Continued use or repair/upgrade of the existing on-site disposal systems in the areas of need is not recommended as the wastewater disposal solution for the entire area of need due to the likelihood that not all existing systems could be repaired or upgraded to conform to Title 5. Continued operation of poor or substandard disposal systems poses public health hazards, environmental degradation and is a real threat to the sole source aquifer.

If it is recommended that the existing on-site wastewater disposal systems in specified Study Areas will continue to be used, then, at a minimum, these systems need to be operated and maintained under a septage management plan. The purpose of a septage management plan is to maintain the operation of septic systems that will protect the groundwater and reduce the expansion of the areas of wastewater disposal need, which require structural solutions such as treatment facility and collection system. The recommended septage management plan should include such items as recommended septage pump-out frequencies and maintenance of on-site wastewater disposal systems.

Public education concerning the importance of proper maintenance of on-site wastewater disposal systems is a beneficial means of prolonging the life of these systems, and will be included as part of the recommended septage management plan.

2. Conventional Title 5 System

This wastewater alternative entails replacing the existing on-site septic systems with Title 5 systems for wastewater management within the wastewater disposal need areas of the Island. Under this option, the systems that do not meet the requirements of Title 5 would be replaced with new Title 5 systems. The remaining septic systems would be upgraded or replaced when it becomes necessary such as when the system fails.

The Massachusetts Environmental Code, 310 CMR 15.000, effective March 31, 1995 govern Title 5 systems. The standard components of a Title 5 system are a building sewer, septic tank, distribution box, soil absorption system, and reserve area. Wastewater exits the building through its building sewer and enters the septic tank where solids are settled and retained. The septic tank effluent flows through the distribution box and to the soil absorption system where it is distributed and treated prior to discharge to appropriate subsurface soils. A schematic of this system is shown on Figure 2-1.

The Title 5 state code dictates certain requirements for the soil absorption system. For instance, the minimum vertical separation distance from the bottom of the stone underlying the soil absorption system to the top of the seasonally high groundwater table is 4 feet in soils where the percolation rate is greater than 2 minutes per inch (mpi) and 5 feet in soils where the percolation rate is less than or equal to 2 mpi. In addition, there must be at least 4 feet of naturally occurring pervious soil below the entire area of the soil absorption system and the reserve area. Title 5 requires a reserve area to be located on the property such that it can be used in case the primary soil absorption system fails. No building, driveway or other physical improvement can be made to the reserve area; it must remain in its pristine state. Setback requirements are also given in the Title 5 code, which identifies the minimum horizontal separation required between the soil absorption system and items such as a drinking water well, property lines and wetlands.

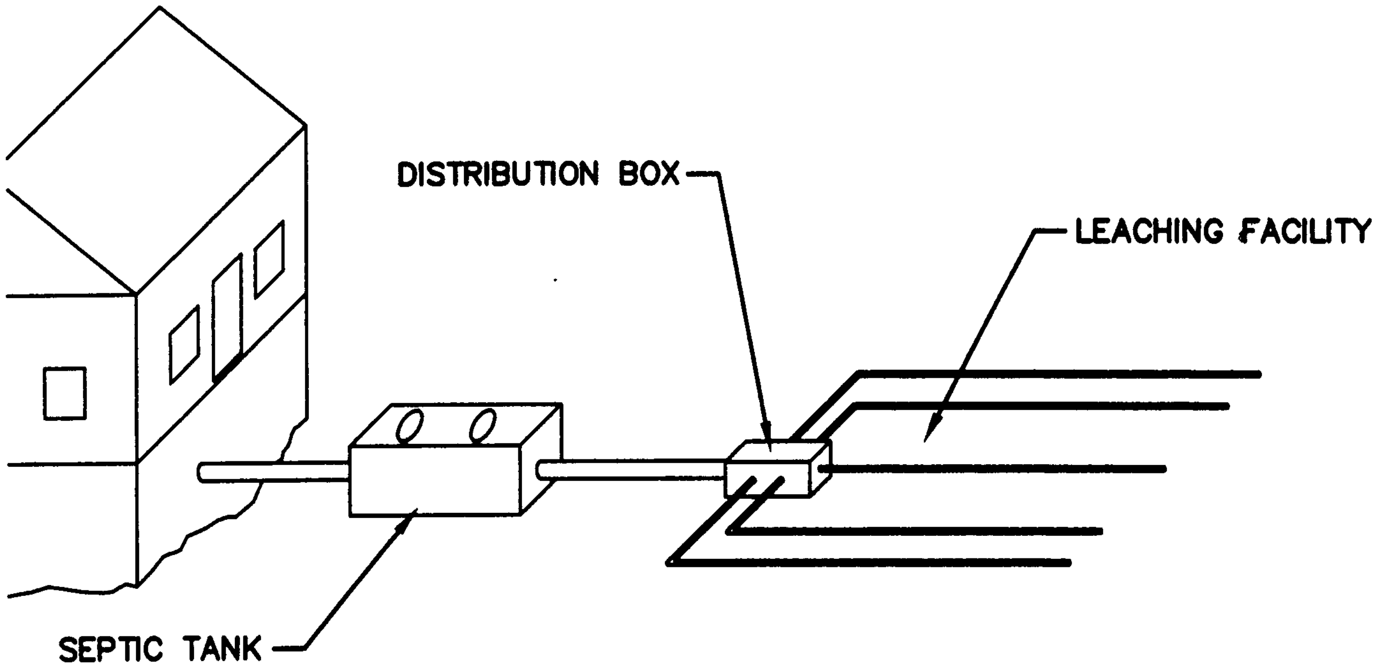


Figure 2-1
Conventional Title 5 System

In order to assess the suitability of replacing existing on-site wastewater disposal systems with new Title 5 systems, several critical criteria need to be addressed. The most common reasons that on-site septic systems fail (including Title 5 systems) is due to overloading, poor construction, and poor maintenance. Assuming the systems are properly constructed and maintained, the remaining issue to address is overloading of the system. Several ways in which a soil absorption system can be overloaded are (1) hydraulically overloading the soil, (2) pollutants clogging within the soil, and (3) insufficient depth of naturally occurring pervious soil that results in improper treatment of the effluent. Standard design practices should deal with each of these issues. The most difficult condition to overcome is subsurface conditions including shallow depth to groundwater and insufficient depth of naturally occurring pervious soil.

Variances from Title 5 code may be granted for septic systems that are unable to meet the groundwater separation distance, depth to impervious layer, or other provisions of Title 5. These systems are referred to as Title 5 Systems with Variances. In these cases, a mounded system would be constructed. A mounded system is not a conventional Title 5 system. Mounded systems are sited in areas where there are slowly permeable soils, shallow permeable soils over creviced or porous bedrock, or permeable soils with high water tables.

C. WASTEWATER COLLECTION, TREATMENT AND DISPOSAL ALTERNATIVES

1. Flow and Waste Reduction

The entire Island relies on public and private water supply wells, which draw from a groundwater supply or aquifer. There are two public water supply companies on the Island; (1) Wannacomet Water Supply Company and (2) Siasconset Water Company. There is also a small drinking water supply well servicing approximately 15 homes in the Wauwinet area of the Island. The private drinking water wells on Island fall under the jurisdiction of the Nantucket Board of Health.

The Town of Nantucket understands the significance of reducing its wastewater flows. One of the ways to ensure this minimization is to implement water conservation measures to reduce water use. In the development of the septage management plan, a significant effort will be devoted to water conservation measures. At this point in time, any efforts have been suggestive in nature due to the jurisdictional issues.

Varieties of water conservation options have been presented by the DEP in the "1992 Water Conservation Standards for the Commonwealth of Massachusetts". These options are discussed below.

Public Education

Public education involves the dissemination of information and getting public support by providing a basic understanding of sound water resources management. One of the three main areas of emphasis that should be included in an educational program is explaining to water users the various costs that are associated with providing water. These costs include planning, engineering, construction, operation, maintenance, treatment, wastewater facilities costs, piping, leak detection, infiltration/inflow reduction measures, compliance costs, salaries and benefits, protection costs, training, and public education. Other areas of emphasis include providing water system users with tangible evidence of the cost savings and environmental benefits that can be attained through water conservation. Materials for education programs may be sought from the Massachusetts Water Works Association, the New England Water Works Association and other organizations, and funded by local water and sewer revenues.

The "1992 Water Conservation Standards" makes the following suggestions for developing a successful public education program: (1) the largest users should be targeted early on to realize the greatest potential savings; (2) public education should reach to the schools to get the children involved; (3) water bills should include a worksheet to enable customers to track water use and conservation, and figure the dollar savings; (4) publicly advertise water conservation successes (and failures) / public service announcements; (5) joint advertising with hardware stores to promote household conservation devices; and (6) provide information on landscaping, gardening, and lawn care practices that promote water conservation.

The Wannacomet Water Supply Company has developed an aggressive public education program through effective communication with its customers and partnerships with the business and school communities on Island. The *Annual Water Quality Report* for 2001 and 2002 details the efforts the Wannacomet Water Supply Company has expended to reach out to the community.

In the Spring of 2001, Wannacomet Water Supply Company joined the Mid-Island Partnership, which is a group of local businesses working together to improve the Island. Wannacomet Water Supply Company also collaborates regularly with the Nantucket Rotary Club.

Each year for the last three years, Wannacomet Water Supply Company participated in the annual Cottage Hospital Health Fair providing information about water quality, the sole source aquifer and water conservation.

Wannacomet Water Supply Company also participates in the education of the youth on Island, working with the elementary, middle and high schools with various programs, including the importance of water conservation. It has developed a "School-to-Career Program" with the local high school to provide internships to seniors. In addition to the Annual Water Quality Report, Wannacomet Water Supply Company distributes various literature for public education on water quality and conservation. Refer to Appendix B for copies.

Leak Detection and Repair

Leak detection and repair is intended to reduce the amount of water lost via leaks in the water distribution system. This maintenance activity is considered most important in older water systems. Leak detection programs can vary but should be carried out regularly by the water suppliers.

Metering

Complete system metering lets customers know how much water they are using, provides Nantucket with valuable knowledge of customer use patterns, assists in demand management programs, and enables Nantucket to bill the customer accurately. With accurate knowledge about current demand, Nantucket can more effectively identify potential water savings, assist specific users to implement water saving measures, determine unaccounted for water, and thereby provide the opportunity to reduce overall system demand and plan efficiently for system growth. Metering costs should be recovered through water rates, and include not only the costs for the metering equipment, but also the costs associated with reading the meters regularly.

In 2002, Wannacomet Water Supply Company transitioned from quarterly to monthly billings for themselves as well as the Siasconset Water Company. This decision was based on three objectives: (1) the need to obtain more accurate water accountability data; (2) improve cash flow; and (3) have the ability to detect potential problems or leaks in the customer's service line and interior plumber sooner rather than later.

In 2002, Wannacomet Water Supply Company completed the implementation of the Automated Meter Reading System. All water meters in the system are now read via a mobile reading systems that is much more accurate than done manually. In order to convert to this automated service, all accounts had to be reviewed and a new meter installed.

Pricing

Full-cost pricing refers to price levels that recover all the direct and indirect costs associated with providing water. For all sectors of water use, knowing the costs associated with providing water and sewer services creates an appreciation of the importance of conserving water and promotes greater understanding of the direct relationship and environmental implications of individual water use and community water resources, especially during seasonal or drought shortages. The pricing structure for water should include the complete cost to run the system. These costs include pumping, maintenance, electricity/fuel, treatment, distribution system operation and maintenance, watershed/well site purchase/protection, capital replacement fund, capital depreciation account, and debt service, purchase and installation of water conservation retrofit equipment, public education program, staff and benefits, and leak detection and repair.

The Nantucket Water Commission held a public informational hearing in 2001 to discuss adopting new water rates, which had not been increased in over ten years. In 2002, the commission adjusted the fees for meter and service installations. A basic rate is charged for water, including the seasonal properties that shut off water for the winter, even if there is zero usage. This charge covers annual operating expenses, debt service, insurance costs, production and distribution system maintenance, billing and customer support services.

Residential Water Use

Residential water use from Massachusetts' public water suppliers amounts to about 450 million gallons per day. Increasing efficiency of use and implementing conservation measures can realize significant savings for consumers and suppliers, both in energy and water costs. Residential users should be encouraged to use the following water saving devices: low-flow showerheads, faucet aerators, toilet displacement devices and/or low-flow toilets, toilet leak detection kits and moisture detectors on underground irrigation systems.

Public Sector Water Use

Public municipal and state buildings and facilities should serve as demonstrations of water saving techniques and concepts. The public should be aware that the state and municipalities are not only doing their part, but also leading the way. Public facilities (schools, hospitals, public offices, etc.) should be built or retrofitted with water conservation devices such as faucet aerators, low flow shower heads, toilet displacement devices or low-flow toilets, and self-closing faucets. Other public sector policies should include charging contractors for using fire hydrants for pipe flushing and other construction purposes.

Industrial, Commercial, and Institutional Water Use

The bulk of industrial, commercial, and institutional water use is for heating, cooling, and processing, but often includes an appreciable sanitary and landscaping component. Conservation measures must be tailored to reflect the type of water use and characteristics of individual facilities. A reduction in facility water uses as well as a reduction in pollutant discharge often accompany the implementation of source reduction programs. Water conservation can be built into an industry's strategy to comply with sewer and discharge requirements and often results in monetary savings following short payback periods. All industrial, commercial, and institutional water users should be required to develop and implement a written water policy addressing at a minimum demand management, leak detection and repair, a program of preventive maintenance, and a program of employee education.

They should also be required to perform water audits to determine the location and amount of water used for heating, cooling processing, sanitary use, and outdoor use. This information could then be used to determine areas to conserve water. Industrial, commercial, and institutional users should also be required to install water saving sanitary devices.

Industrial, Commercial, and Institutional Water Use is relatively small, accounting for approximately five percent of the land use on Island. As previously mentioned, Wannacomet has partnered with business groups on Island and the Rotary Club working towards Island sustainability.

Water Supply System Management

The Nantucket Water Commission and more specifically the Wannacomet Water Supply Company has taken advantage of many options for improving the efficiency of its operations, educating the public and encouraging water conservation by consumers. The public education to date developed by Wannacomet Water Supply Company provides a framework for implementing these standards and establishing long-term priorities and plans for system maintenance, source protection, and, as necessary, new source development.

On April 12, 1999 at annual Town Meeting, Article 68, Nantucket adopted a set of Conservation Bylaws, which were approved August 10, 1999 defining the public water supply use restrictions on Island. Included in this bylaw under Chapter 114 are the following:

- Authority;
- Purpose;
- Definitions;
- Declaration of a State of Water Supply Conservation;
- Restricted water uses;
- DEP and Public Notification of a State of Water Supply Conservation;
- Termination of Water Supply Conservation notice;
- State of Water Supply Emergency/DEP compliance; and
- Penalties.

2. Decentralized Facilities

The Study Areas of wastewater disposal need identified in the Phase I Document are currently relying on individual on-site wastewater disposal systems for wastewater treatment and disposal. A majority of these systems are substandard, provide a low level of treatment, and do not comply with the requirements of Title 5. The Phase I Document identified eleven study areas that were determined to need some sort of upgraded wastewater disposal, whether it be a stringent septage management plan, sewage collection system, cluster systems serving a limited number of homes, or on-site innovative/alternative disposal systems. This section will discuss the option of providing each property that has an existing on-site wastewater disposal system with an on-site or decentralized innovative/alternative wastewater disposal system. The systems considered include (1) STEP/Cluster Systems; (2) Small-scale Wastewater Treatment Plants; and (3) On-Site Innovative/Alternative Systems.

This alternative will be fully discussed and analyzed in those areas on Island affected with an embayment included in the State Estuary Project. A coordination of efforts with the Estuary Project will ensure long-term on-site wastewater disposal in compliance with the final results or Total Maximum Daily Load (TMDL) of this project in the Nantucket Harbor, Sesachacha Pond and Madaket Harbor areas.

A Title 5 system achieves only a nominal level of treatment in terms of Biochemical Oxygen Demand (BOD_5) and Total Nitrogen removal. Based on the compilation of various studies and DEP data, typical effluent concentrations from a conventional Title 5 septic tank are as follows: the effluent BOD_5 concentration is 170 mg/L; the effluent Total Suspended Solids (TSS) concentration is 60 mg/L; and the effluent Total Nitrogen concentration is 42 mg/L with the majority of this total being ammonia nitrogen. Comparing these effluent concentrations with the influent concentrations noted during the evaluation of Title 5, (BOD_5 = 300 mg/L, TSS = 300 mg/L, and TN = 45 mg/L), the conventional system can achieve about 43 percent removal of BOD_5, about 80 percent removal of TSS and only 6 percent removal of Total Nitrogen. These influent concentrations to individual septic tanks were found to be higher than those of a medium strength wastewater. According to “Wastewater Engineering: Treatment, Disposal, Reuse” by Metcalf and Eddy, a medium strength wastewater has a Biochemical Oxygen Demand (BOD_5) of 220 milligrams per liter (mg/L), a Total Suspended Solids (TSS) of

220 mg/L, and a Total Nitrogen (TN) concentration of 40 mg/L. A typical wastewater treatment facility will remove 85 percent of the BOD_5 and TSS and 60 to 80 percent of the Total Nitrogen. These parameters are used in this section only to show the removal efficiency of the Title 5 system. Title 5 systems do not adequately remove nutrients from the wastewater before it enters the leaching field. From this it can be concluded that even a properly installed and operating Title 5 septic system will still discharge levels of pollutants which impact the quality of the receiving groundwater, in cases where the groundwater enters the bottom of the soil absorption area.

STEP/Cluster Systems

One decentralized treatment alternative to a Title 5 system considered was the Septic Tank Effluent Pump (STEP) System which pumps septic tank effluent through a pressurized sewer to a small-scale, off-site subsurface disposal cluster system or treatment facility. This system consists of a septic tank that concentrates and collects the solids from the wastewater and a pump, which pumps the septic tank effluent to a cluster subsurface disposal system or treatment facility. Schematics of a typical STEP System and Subsurface Cluster System are shown on Figure 2-2 and Figure 2-3, respectively.

Based on Title 5 requirements, a maximum flow of 10,000 gallons per day is allowed to be discharged to a subsurface trench disposal system before a sewage treatment plant is required. A treatment facility may or may not be required depending on the specific wastewater flow from each of the individual need areas. The land area required for a trench system for 10,000 gallons per day (about 45 residential/ commercial units) is about 17,800 square feet, assuming an optimal percolation rate of less than 5 minutes per inch with Class I soils (sands, loamy sands) equaling 0.74 GPD/SF (based on Title 5 requirements).

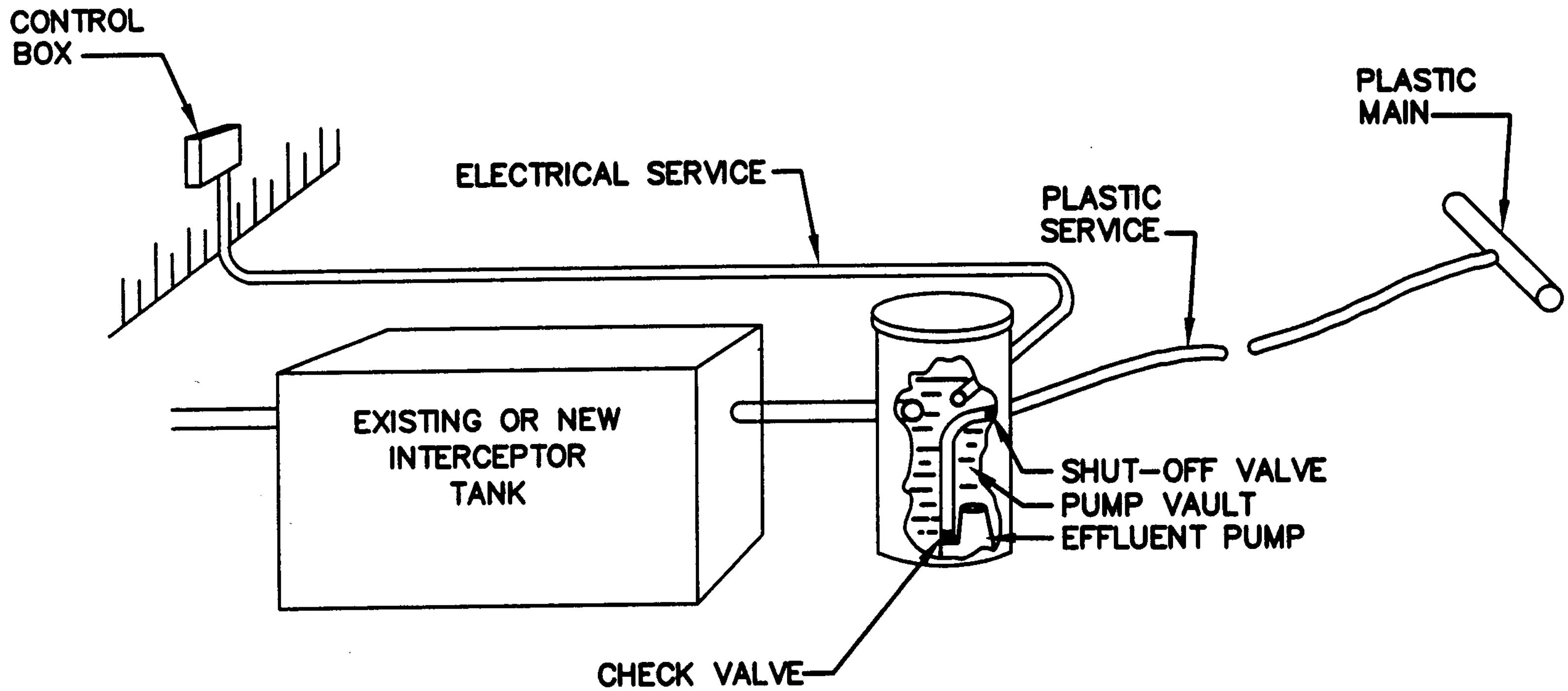


Figure 2-2
Typical STEP System

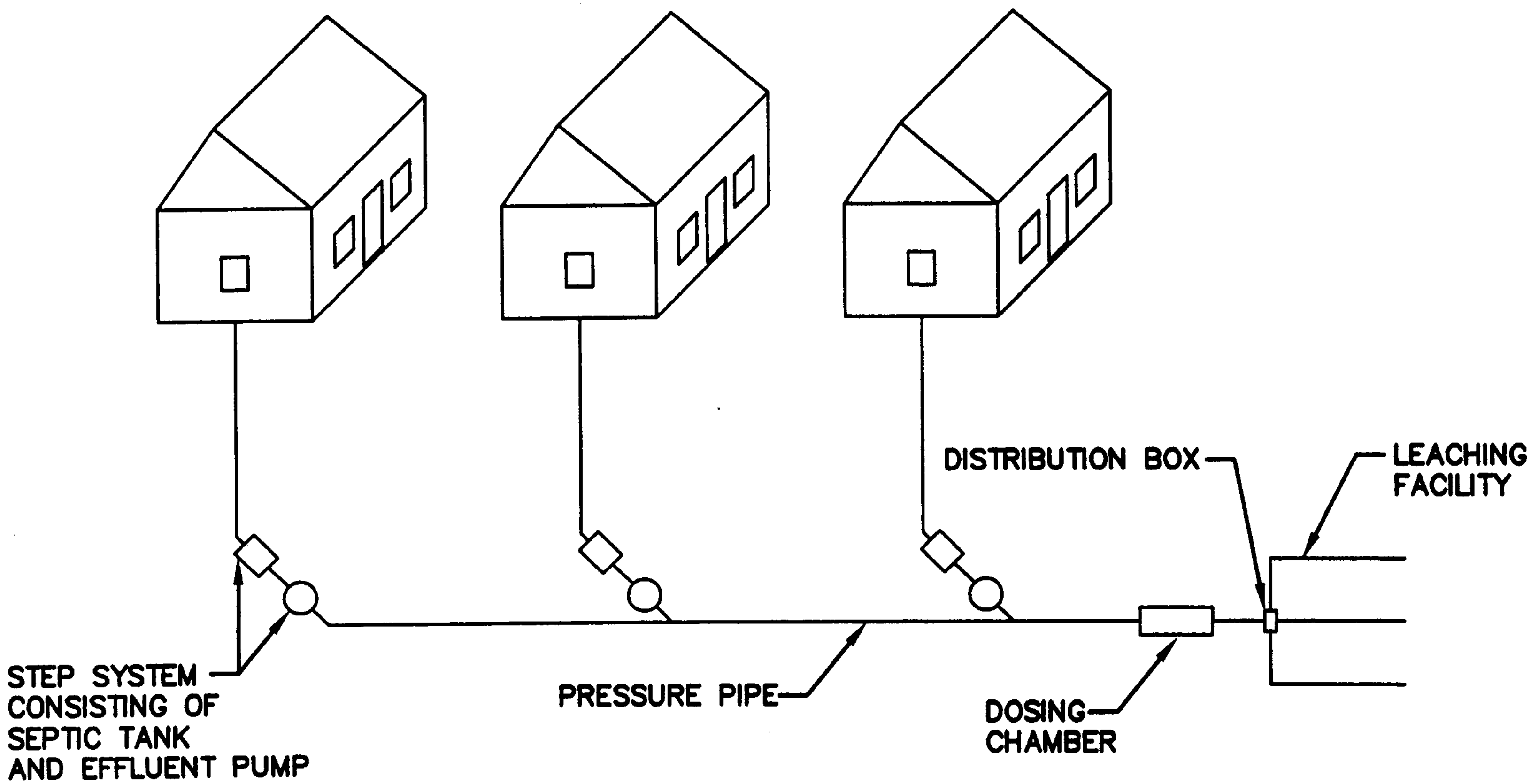


Figure 2-3
Subsurface Cluster System

For the purpose of this calculation, it was assumed that each trench is 2 feet wide by 2 feet deep and 100 feet long, and that there is 6 feet between trenches. Title 5 also requires space to be set aside for a reserve area in the event of system failure; however, it allows the space between trenches to be used as the reserve. Therefore, the total area required for 10,000 gallons per day is 17,800 square feet (approximately 0.4 acres), which represents the minimum size of any one system based on the above assumptions. This area only includes the area needed for the subsurface disposal system itself, and does not include required setbacks from property lines, water bodies, buildings, slopes, etc. The land area required due to setback limitations can only be determined when an appropriate disposal area has been identified and designated, but an additional 50 percent would not be excessive. Hence 0.6 acres would be appropriate. Although the foregoing space requirements are needed to meet all of the setback limits of Title 5, it is quite common for septic systems to be sited within smaller spaces and still function well.

STEP systems can be used to pump the effluent from individual residences through a pressurized sewer to a small-scale treatment facility. As with a conventional Title 5 system, the septic tanks must be routinely pumped to remove solids.

Small-Scale Wastewater Treatment Plants

If more than 10,000 gallons per day is to be treated, a subsurface disposal system will no longer be adequate and a treatment plant will be required. A typical plant consists of an enclosed building which would include: anoxic pretreatment, primary settling and a sludge storage tank; a flow equalization and pump chamber in order to normalize flow over 24-hour periods; an aerobic biological process for organics reduction and nitrification; a secondary clarifier; an anoxic denitrification process; sand filtration and disinfection. The building would also typically include a laboratory, office and a utility and equipment room. The amount of land required for the plant itself and related site items varies with the capacity of the plant. The size of the disposal fields, however, is based directly upon the flow and according to the "Guidelines for the Design, Construction, Operation and Maintenance of Small Sewage Treatment Facilities with Land Disposal," January 1988 (as published by the Massachusetts Department of Environmental Quality Engineering, Division of Water Pollution Control), a reserve area tested and shown to be sufficient to replace the capacity of the original leaching area would be required. Again, assuming an optimal percolation rate with good soils, open sand beds can treat 5.0 gallons per day/square feet and a subsurface trench system can treat 2.5 gallons per day/square feet (based upon "Guidelines for the Design, Construction, Operation and Maintenance of Small Sewage Treatment Facilities with Land Disposal"). For the open sand bed alternative, this would consequently result in a much smaller field of 2,000 square feet. Including 2,000 square feet for a reserve area, the total land area required for the open sand bed alternative would be 4,000 square feet (about 0.1 acre) for the equivalent wastewater flow of 10,000 gallons per day. Assuming trenches that are 2 feet wide by 2 feet deep by 100 feet long and a 6 foot wide area between trenches, a subsurface trench disposal system would occupy 5,000 square feet. The area between the trenches can be used as the reserve area. Therefore, the total area required for the equivalent 10,000 gallons per day flow utilizing a subsurface trench system would be 5,000 square feet to over 100,000 square feet depending upon the percolation rate of the soil.

On-Site Innovative/Alternative (I/A) Systems

Title 5 allows for the use of Innovative/Alternative (I/A) technologies with DEP approval. Periodically, the DEP issues an updated memorandum entitled: "Title 5 I/A Technologies Approved for use in 310 CMR 15.000 Massachusetts". This memorandum provides a description and status for a variety of innovative and alternative technologies. A number of these I/A technologies provide enhanced wastewater treatment with nitrogen reduction. Of these technologies, the on-site alternative systems that will be evaluated for use in each of the areas or wastewater disposal need are the Recirculating Sand Filter, Amphidrome™ Process, Bioclere™ System, Cromaglass®, RUCK® System, and the Single Home FAST®.

According to Title 5, "alternative systems, when properly designed, constructed, operated and maintained, may provide enhanced protection of public health, safety, welfare and the environment." I/A systems are recommended for use in areas where a conventional Title 5 system cannot be sited. Title 5 details an approval process which proponents of each respective innovative/alternative technology must adhere to in order to gain approval of their alternative system. DEP approves the I/A technologies under four main categories: Approval for Piloting; Provisional Approval; Certification for General Use; and Approval for Remedial Use. These categories are described in the following paragraphs:

- Piloting Approval, which is addressed in 310 CMR 15.285, allows for controlled field testing and technical demonstration of I/A technologies. Pilot systems can only be built where the establishment to be serviced has access to a sewer system or a conventional Title 5 system to which it can be connected if the alternative system fails. If the I/A technology is approved for piloting it can be implemented at a maximum of fifteen locations. A minimum of 18 months of environmental monitoring must be performed at each facility. Piloting is considered successful when at least 75 percent of the systems perform satisfactorily over 12 months.

- Provisional Approval, which is addressed in 310 CMR 15.286, provides for broader field testing of the I/A technologies which appear to be technically capable of providing equivalent levels of environmental protection as a conventional Title 5 system. Under the provisional approval testing, it will be determined if the technology is technically capable of providing this level of treatment over a broader use than the pilot, and whether any further conditions regarding operation, maintenance, or monitoring are necessary to ensure such environmental protection. Provisional approval is contingent on successful completion of the piloting program. Systems that have completed two (2) years of general use in another state will also be considered for provisional approval. A three (3) year performance evaluation must be performed on the first fifty (50) systems. As with piloting, establishments to be serviced by provisional systems must be capable of connecting to a sewer system or a conventional Title 5 system, if the alternative should fail.

- Certification for General Use, which is addressed in 310 CMR 15.288, facilitates the use of I/A technologies which have shown that they provide the level of environmental protection which is offered by a conventional Title 5 on-site system. In order for an I/A technology to be Certified for General Use, it must have a success rate during the provisional process of 90 percent. The DEP also establishes nutrient removal credits for I/A technologies that are more effective than a conventional Title 5 system in removing nitrates.

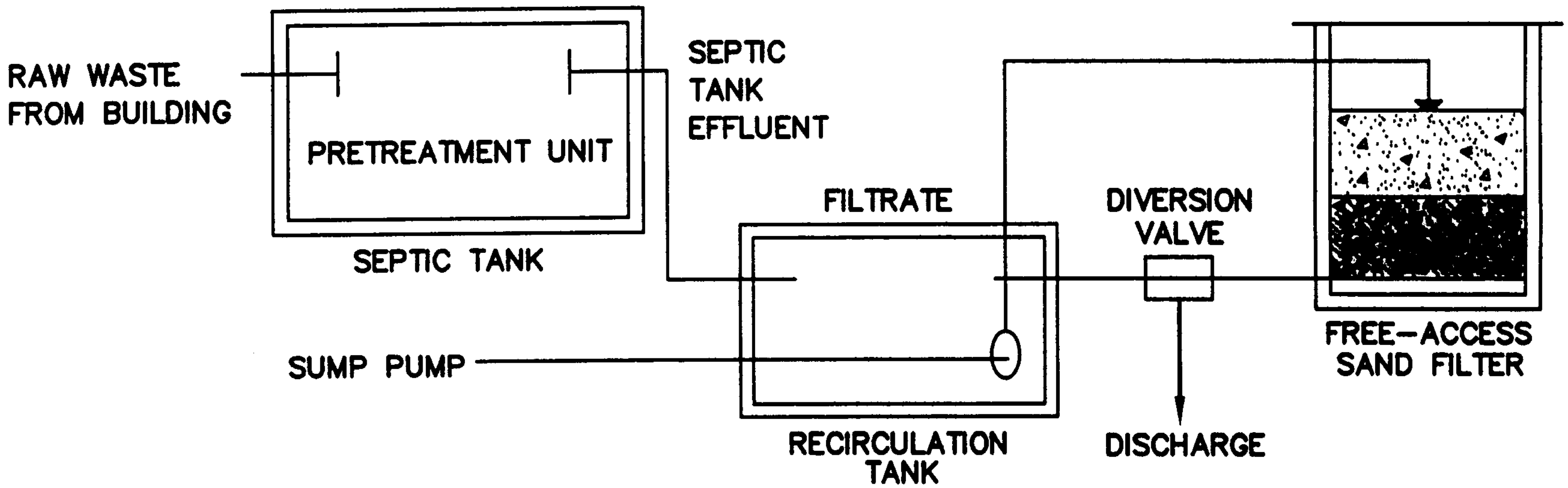
- Remedial Approval, which is addressed in 310 CMR 15.284, provides for rapid approval of I/A technologies needed to upgrade currently failing or non-conforming systems. In order for the technology to be considered for remedial approval, it must have at least one year of general use in a state with climate conditions similar to Massachusetts. Remedial approval is a “stopgap measure”. It is not intended that the data collected for a remedial use approval will be used to support an application for piloting, provisional or general certification.

Recirculating Sand Filter

The Recirculating Sand Filter (DEP approval March 1995) is an alternative treatment system, which consists of a septic tank, a recirculation tank and pump, a sand filter with underdrains, and a soil absorption system. The wastewater flows from the building through its building sewer to a septic tank where solids are settled and retained. Effluent from the septic tank flows by gravity and is collected in the recirculation pump chamber. Within the recirculation pump chamber, the effluent from the septic tank and the effluent, which is returned from the sand filter, are mixed. This mixture is then periodically pumped and evenly distributed over the sand filter bed surface. After percolating through the sand filter, the effluent is collected by underdrains and either recirculated back by gravity flow to the recirculation pump chamber or, if the chamber is full, discharged to a soil absorption system. A typical schematic of this system is shown on Figure 2-4.

The Recirculating Sand Filter was issued a Certification for General Use and Remedial Use Approval by DEP in March 1995. The Recirculating Sand Filter must meet secondary treatment standards of 30 mg/L BOD_5 and 30 mg/L TSS with a minimum removal of 85 percent of the influent BOD_5 and TSS. The effluent Total Nitrogen concentration must not exceed 25 mg/L and the system shall remove a minimum of 40 percent of the influent total nitrogen concentration.

Generally, the Recirculating Sand Filter achieves a higher level of treatment compared to a conventional Title 5 system. A variety of papers and studies have been written on Recirculating Sand Filters showing very high levels of treatment. Some of these studies show that typical BOD_5 and TSS removals are greater than 90 and 85 percent, respectively. Typical BOD_5 and TSS effluent concentrations have been less than 15 mg/L. These studies also show that the Recirculating Sand Filter is capable of obtaining high levels of Total Nitrogen removal of up to 75 percent. The effluent Total Nitrogen concentration has been recorded to be as low as 10 mg/L. The Recirculating Sand Filter is the I/A technology that is specifically covered in Title 5. The treatment capabilities of all I/A technologies are compared to the Recirculating Sand Filter. In discussions with DEP, the Recirculating Sand Filter does not always meet the effluent standards required, however, due to DEP's familiarity with the process and the majority of the data, which they have reviewed, it is their opinion that the Recirculating Sand Filter is capable of enhanced wastewater treatment compared to a conventional Title 5 system. DEP is confident of the system's treatment capabilities and ability to protect public health and the environment.



SOURCE: EPA MANUAL, WASTEWATER TREATMENT/DISPOSAL FOR SMALL COMMUNITIES

Figure 2-4
Recirculating Sand Filter

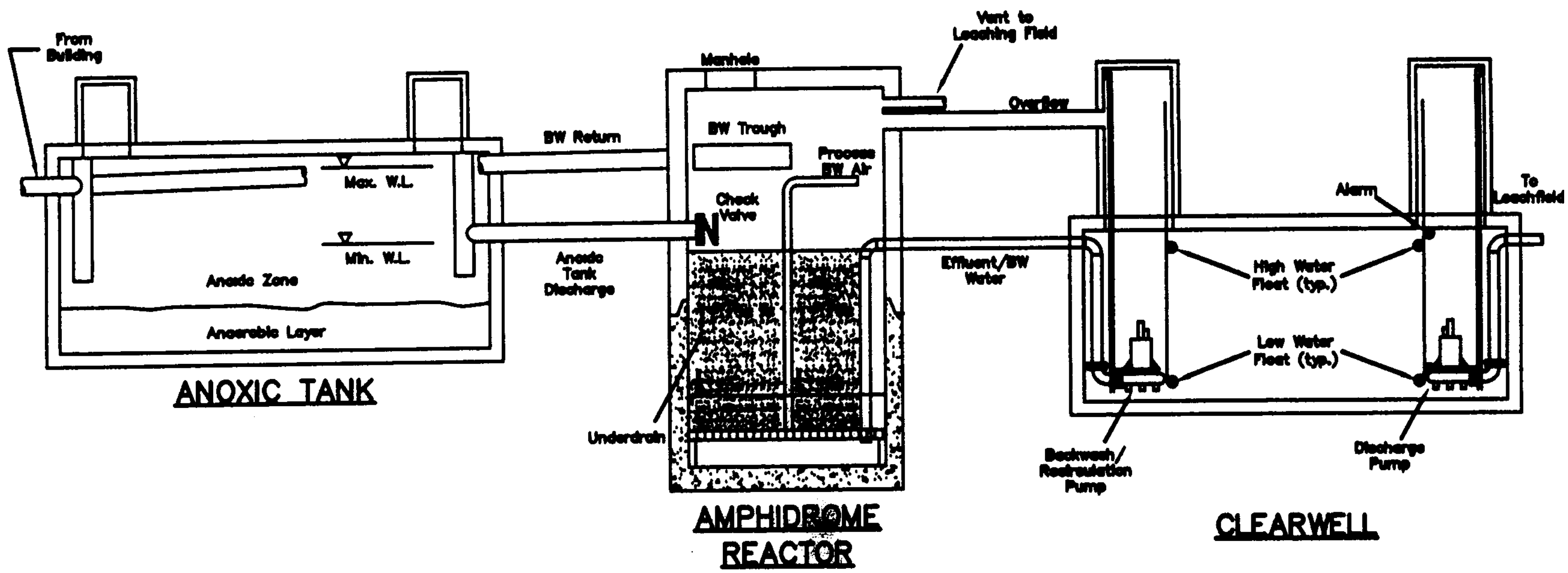
Amphidrome™ Process

The Amphidrome™ (DEP piloting approval June 1995) system is a fixed film, sequencing batch biological filter. The Amphidrome™ primarily consists of an anoxic equalization tank, the Amphidrome™ reactor/sand filter, and a clearwell. As with a conventional Title 5 system, a soil absorption system is also required. Wastewater flows from the building through its building sewer, combines with recycle flow from the clearwell and enters the anoxic equalization tank. From the equalization tank, the wastewater flows to the anoxic pretreatment/sludge storage area. The equalization tank stores flow prior to treatment through the biological filter. The anoxic pretreatment/sludge storage area settles solids, provides denitrification for the recycled flow using the new flow as the carbon source, and stores and digests sludge.

A batch of wastewater flow is sent by gravity from the anoxic equalization tank, down through the filter, to the clearwell. This flow of wastewater is then reversed by pumping from the clearwell, up through the filter, back to the equalization tank. This cycle is repeated several times until the required level of treatment is achieved. The cycles are alternated between aerobic and anoxic modes. The wastewater flows through the filter to the clearwell. The purpose of the clearwell is to provide storage for the flow to be recycled or to be used as backwash. Once the degree of treatment is obtained, the effluent is discharged to a soil absorption system. A schematic of this system is shown on Figure 2-5.

The Amphidrome™ Process was issued Piloting Approval by DEP in June 1995. It is approved to be piloted as an equivalent technology to a Recirculating Sand Filter. The Amphidrome™ Process must meet secondary treatment standards of 30 mg/L BOD_5 and 30 mg/L TSS and a minimum of 85 percent of the influent BOD_5 and TSS must be removed. The system must also meet the nitrogen loading design standards as follows:

- For residential systems, the effluent total nitrogen concentration shall not exceed 19 mg/L and the system shall remove a minimum of 55 percent of the influent total nitrogen concentration.
- For non-residential systems, the effluent total nitrogen concentration shall not exceed 25 mg/L and the system shall remove a minimum of 40 percent of the influent total nitrogen concentration.



SOURCE: F.R. MAHONEY & ASSOCIATES, INC.

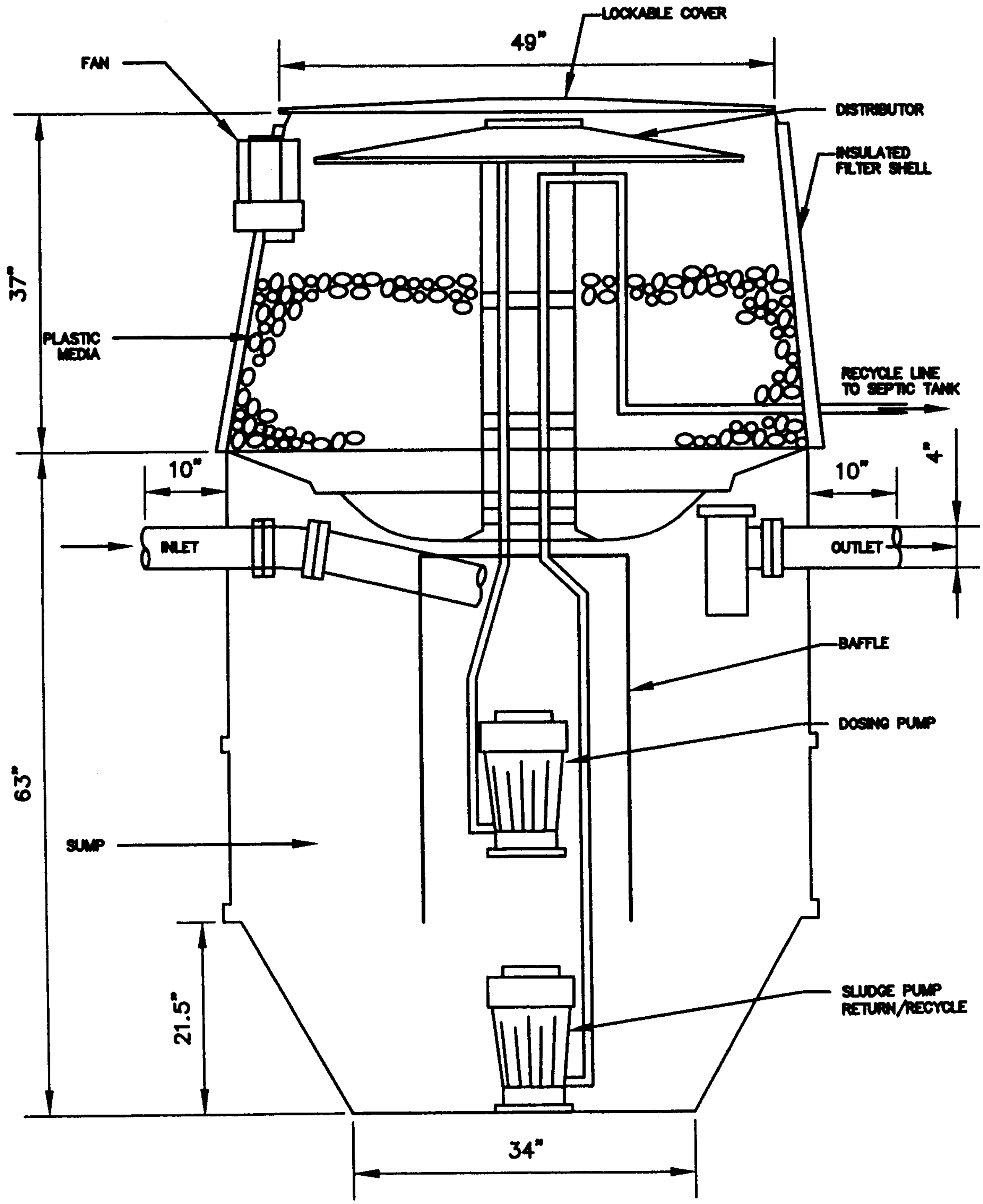
Figure 2-5
Amphidrome™ Process

DEP requires that the influent and effluent parameters for this technology be monitored monthly for the first year of operation. The proponent of this system is seeking to show that the effluent total nitrogen concentration does not exceed 10 mg/L and that the system removes a minimum of 76 percent of the influent Total Nitrogen. Therefore, the ultimate goal of the Amphidrome™ Process is to achieve an effluent with a Total Nitrogen concentration of less than 10 mg/L.

Bioclere™ System

The Bioclere™ (DEP general remedial and provisional approval March 1995) is essentially a modified tricking filter, which can be added to a Title 5 system between the septic tank and the soil absorption area. Wastewater flows from an establishment through its building sewer, into a standard Title 5 septic tank in which primary settling occurs. Effluent from the septic tank then flows by gravity to the baffled sump portion of the Bioclere™. A dosing pump within this sump intermittently pumps the effluent up to the top of the media bed for distribution. The wastewater trickles through this bed of highly permeable plastic media and then mixes with the wastewater in the bottom of the Bioclere™. This mixture is then recirculated to the top of the media bed in a continuous cycle. Sloughed biomass and particles not removed through the septic tank or the filter settle out in the base of the Bioclere™ unit from where a portion of the effluent sludge is pumped back to the septic tank. The remaining portion of the effluent from the Bioclere™ is discharged to a conventional leaching area. A schematic of this system is shown on Figure 2-6.

The Bioclere™ was issued a Certification for General Use, Provisional Use Approval and Remedial Use Approval by DEP in March 1995. The Bioclere™ must meet secondary treatment standards of 30 mg/L BOD_5 and 30 mg/L TSS with a minimum removal of 85 percent of the influent BOD_5 and TSS. The system must also meet the nitrogen loading design standards as follows:



SOURCE: BIOCLERE – RHODE ISLAND ON-SITE WASTEWATER TRAINING PROGRAM

Figure 2-6
Bioclere™ System

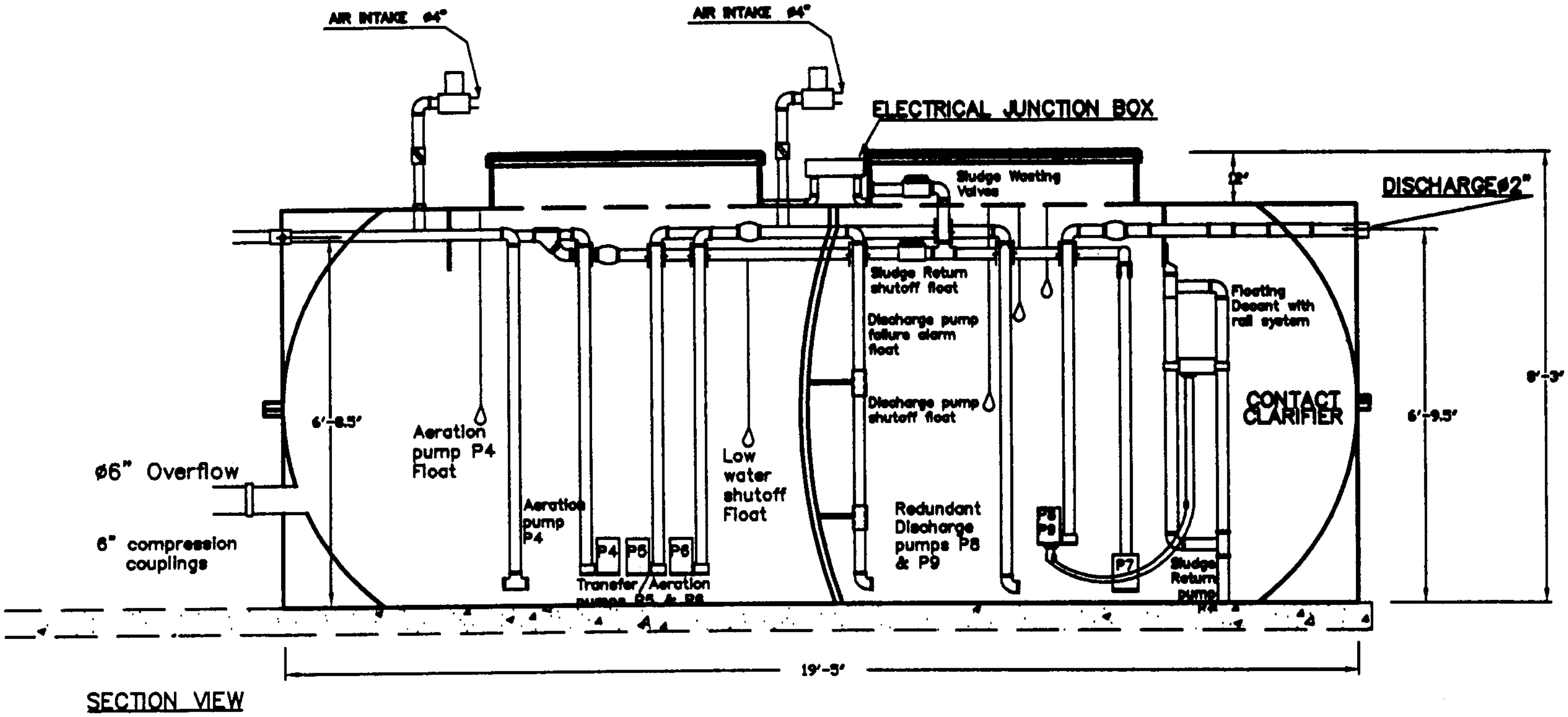
- For residential systems, the effluent total nitrogen concentration shall not exceed 19 mg/L and the system shall remove a minimum of 55 percent of the influent total nitrogen concentration.

- For non-residential systems, the effluent total nitrogen concentration shall not exceed 25 mg/L and the system shall remove a minimum of 40 percent of the influent total nitrogen concentration.

A variety of papers and studies have been written on the Bioclere™ system showing high levels of treatment. Some of these studies show that typical BOD_5 and TSS removals are about 85 and 70 percent, respectively. Typical BOD_5 and TSS concentrations are about 50 and 70 mg/L, respectively. They also show that the Bioclere™ is capable of obtaining high levels of Total Nitrogen removal of up to 25 percent above that of a conventional Title 5 system. The effluent Total Nitrogen concentration has been recorded to be less than 30 mg/L.

Cromaglass®

The Cromaglass® (DEP general piloting use approval September 1995) system is composed of a fiberglass tank, which is separated into three chambers and operates as a Sequencing Batch Reactor (SBR). Wastewater flows from the building through its building sewer and enters into the first chamber of the Cromaglass® unit. Within the first chamber, which is referred to as the "Solids Retention Section", large inorganic particles are retained. Wastewater, with smaller particles and broken organic solids, flow through the grit screen into the second chamber. This chamber is referred to as the "Aeration Section" where biological treatment by aeration occurs. New inflow is continuously mixed with the existing activated sludge, which is maintained in this chamber and aeration lasts for several hours. In this chamber, an anoxic period is also provided for denitrification. After the anoxic period, a batch of treated wastewater is transferred at preset intervals to the third chamber for clarification. This chamber is called the "Clarification Section," and is filled until the mixed liquor overflows the weir back into the Aeration Section. The chamber is then isolated allowing solids separation to occur by settling under quiescent conditions for about one hour. The sludge, which collects at the bottom of the chamber, is either recycled by pump to the Aeration Section or transferred to a sludge collection tank. After clarification, a batch of treated wastewater effluent is discharged to the soil absorption system. A schematic of the Cromaglass® system is shown on Figure 2-7.



SOURCE: CROMAGLASS CORPORATION

Figure 2-7
Cromaglass® System

The Cromaglass® system was issued a Certificate for General Use and Piloting Approval by DEP in September 1995. Under the General Use category, the Cromaglass® system must meet the environmental protection requirements of a conventional Title 5 system. It is also approved to be piloted as an equivalent technology to a Recirculating Sand Filter. The Cromaglass® must meet secondary treatment standards of 30 mg/L BOD_5 and 30 mg/L TSS and a minimum of 85 percent of the influent BOD_5 and TSS must be removed. The system must also meet the nitrogen loading design standards as follows:

- For residential systems, the effluent total nitrogen concentration shall not exceed 19 mg/L and the system shall remove a minimum of 55 percent of the influent total nitrogen concentration.
- For non-residential systems, the effluent total nitrogen concentration shall not exceed 25 mg/L and the system shall remove a minimum of 40 percent of the influent total nitrogen concentration.

DEP requires that the influent and effluent parameters for this technology be monitored monthly for the first year of operation. As with the Amphidrome™ Process, the proponent of the Cromaglass® is seeking to show that the effluent Total Nitrogen concentration does not exceed 10 mg/L and that the system removes a minimum of 76 percent of the influent Total Nitrogen.

RUCK® System

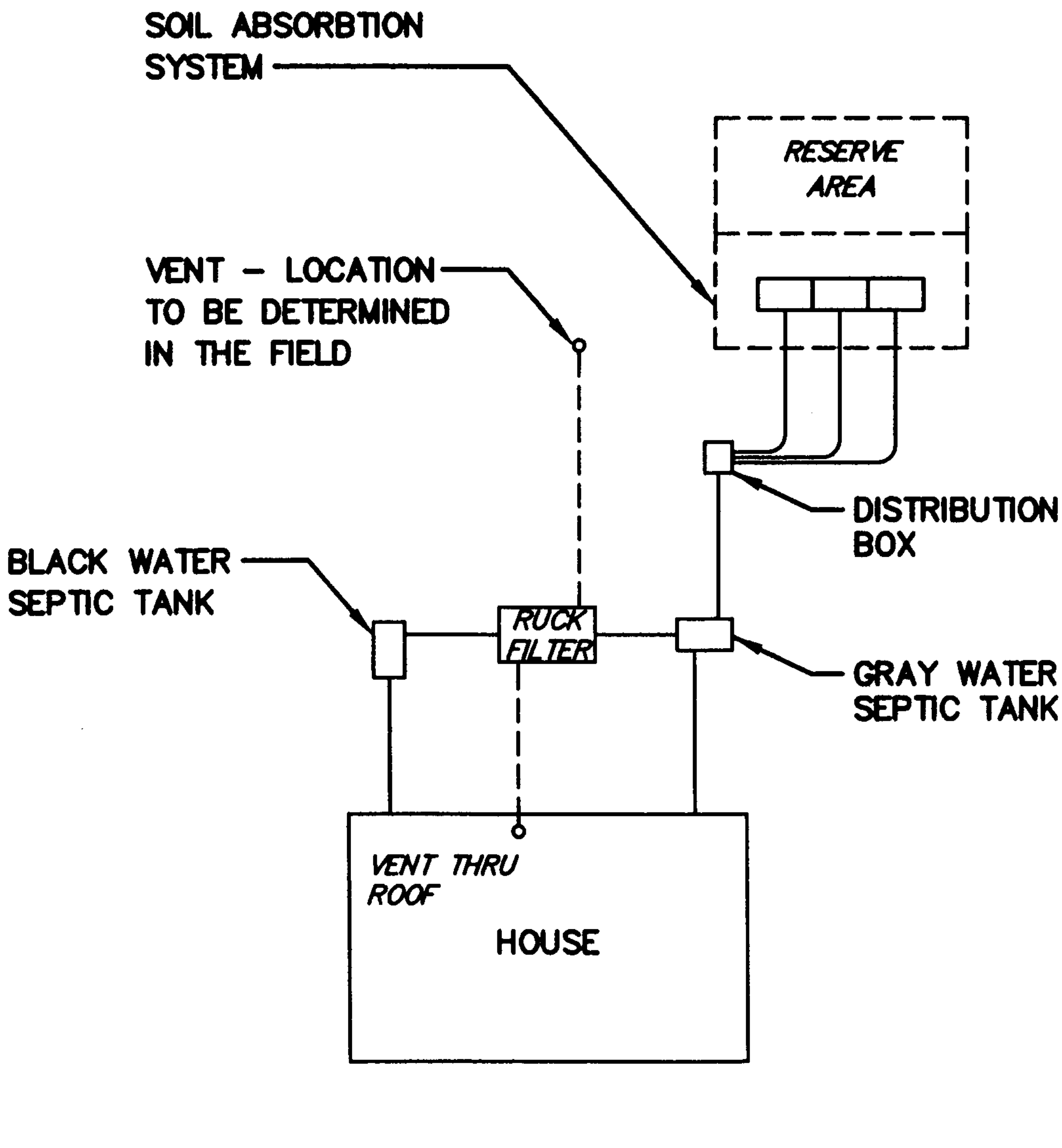
The RUCK® (DEP general use approval March 1995) system is referred to as a passive nitrogen removal system. The components of the RUCK® system consist of two parallel septic tanks, the nitrifying RUCK® filter, and a conventional subsurface leaching area. One septic tank receives blackwater, which is the waste from toilets and drains equipped with garbage grinders such as a kitchen sink; the other tank receives graywater, which is the waste from showers, washing machines, dishwashers and other sinks, also called washwater. These wastes must be separated at the source, therefore an establishment will need to have the appropriate dual plumbing system or make plumbing changes to make this possible. Blackwater flows from the establishment through the blackwater designated building sewer to the blackwater septic tank where solids settle. The effluent from this blackwater tank is then passed through the single pass aerobic RUCK® sand filter. After the wastewater passes through this filter, it is collected at the bottom of the filter, and is transferred to the graywater septic tank. Effluent from the RUCK® filter is combined with graywater from the establishment in the graywater septic tank. The denitrified effluent from this tank is then transferred to a conventional soil absorption system. A schematic of this system is shown on Figure 2-8.

The RUCK® System was issued a Certification for General Use Approval by DEP in March 1995. The RUCK® must meet secondary treatment standards of 30 mg/L BOD_5 and 30 mg/L TSS with a minimum removal of 85 percent of the influent BOD_5 and TSS. The effluent Total Nitrogen (TN) concentration must not exceed 19 mg/L and the system shall remove a minimum of 55 percent of the influent TN concentration. The proponent of the system has indicated that the RUCK® system has achieved between 60 to 85 percent removal of BOD_5 and TSS and has achieved better than 55 percent removal of Total Nitrogen. DEP requires sampling at three points in the process: the blackwater effluent (septic tank effluent); graywater influent; and the distribution box (final effluent) to the soil absorption system.

Single Home FAST®

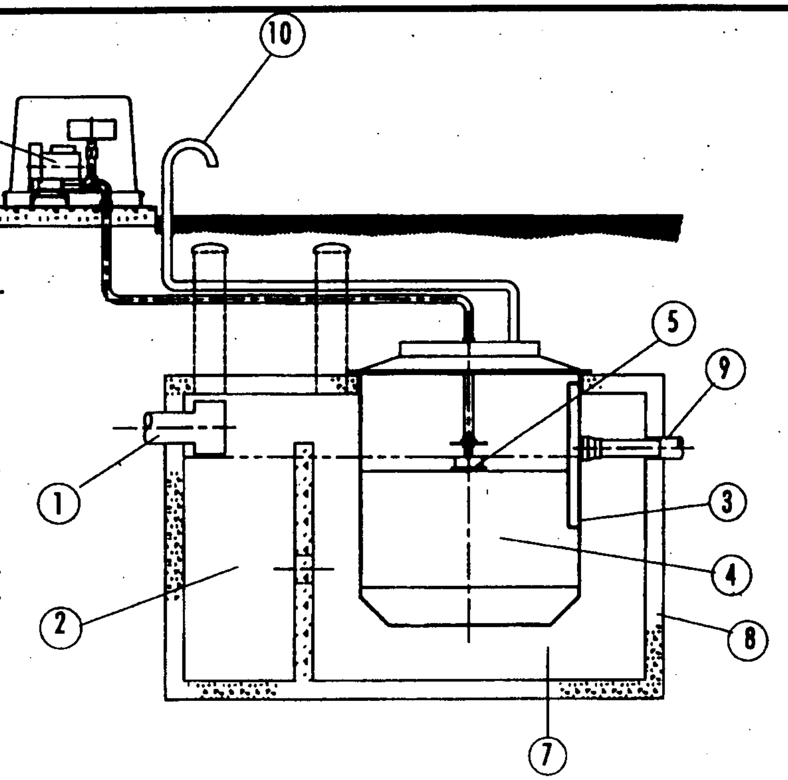
The Single Home FAST® (DEP general, provisional and remedial use approval March 1995) system is a Fixed Activated Sludge Treatment (FAST) system. The FAST® Process consists of two zones -- a primary settling zone and an aerobic biological zone. The FAST® unit is essentially a fixed film media bed, which is inserted into a 1,500 to 2,000 gallon septic tank. A schematic of this system is shown on Figure 2-9.

The FAST® System was issued a Certification for General Use, Provisional Use Approval and Remedial Use Approval by DEP in March 1995. The FAST® System must meet secondary treatment standards of 30 mg/L BOD_5 and 30 mg/L TSS with a minimum removal of 85 percent of the influent BOD_5 and TSS. The system must also meet the nitrogen loading design standards.



SOURCE: INNOVATIVE RUCK SYSTEMS, INC.

Figure 2-8
RUCK® System



The low-profile Single Home FAST® treats flows of up to 10 persons or a five bedroom home. Larger and multiple units are also available. Contact your distributor for details.

Standard Features:

1. Influent from House Sewer Line - connects directly from the house sewer line pipe and can handle the equivalent of 10 persons or a five bedroom home

2. Primary Settling Zone - encourages rapid settling of large solids entering the unit and away from the Fast® media

3. Treatment Insert - packed with bacteria-laden media, the liquid circulating through the insert is essentially clear and free of suspended solids, unlike those in conventional activated sludge systems

4. FAST® Media - houses the "friendly bacteria" in an environment ideal for rapid bacterial growth. The high surface area-to-volume ratio ensures a continuous level of treated effluent

5. Draft Tube - disperses the liquid evenly over the upper surface of the media, providing continuous circulation of the wastewater

6. Totally Enclosed Blower - supplies air which provides oxygen for the bacteria to grow and multiply

7. Solids Collection Zone - holds the solids which have settled. Occasional solids removal is required

8. System Tank - houses the system. Available in concrete or fiberglass configurations

9. Odorless Liquid Effluent - discharges into the leach field or disposal well after being disinfected

10. Vent - ventilates treatment section

SOURCE: SMITH & LOVELESS, INC.

Figure 2-9
Single Home FAST®

The proponent of this system is seeking to show that the effluent Total Nitrogen concentration does not exceed 15 mg/L and that the system removes a minimum of 64 percent of the influent Total Nitrogen. Therefore the ultimate goal of the FAST® System is to achieve an effluent with a Total Nitrogen concentration of less than 15 mg/L. DEP has recognized that the FAST® unit is capable of 90 to 95 percent reduction in BOD_5 and TSS. The effluent concentrations of BOD_5 and TSS are reported to be less than 30 mg/L. It is also recognized that the unit can reduce the Total Nitrogen entering the system to 19 mg/L.

- For residential systems, the effluent total nitrogen concentration shall not exceed 19 mg/L and the system shall remove a minimum of 55 percent of the influent total nitrogen concentration.

- For non-residential systems, the effluent total nitrogen concentration shall not exceed 25 mg/L and the system shall remove a minimum of 40 percent of the influent total nitrogen concentration.

Monitoring results for the six Innovative/Alternative (I/A) Technologies discussed above were compiled and are summarized in Table 2-1. This Table shows the average effluent concentrations and percent removals for several systems in operation for each I/A technology. Also, shown on this Table is the DEP requirements and goals set for each system. The monitoring results are variable in that not all technologies were sampled and tested under the same conditions. Variable influent and effluent concentrations were recorded depending on the source, day and time of day each sample was taken. Also, different methods of sampling and testing were used for each technology. Although the monitoring methods and results were different for each system and cannot be used to rank the technologies, the results were helpful in evaluating the technologies in terms of whether or not the technology achieved the effluent requirements set by DEP. In summary, the monitoring results show that all of the technologies have the capability of achieving enhanced treatment over that of a conventional Title 5 system. Of the systems and monitoring results analyzed, the Recirculating Sand Filter, the Amphidrome™ Process, the Cromaglass® and the FAST® system achieved their respective DEP effluent and removal requirements more frequently than the other technologies. These systems achieve a higher degree of wastewater treatment than can be achieved by a Conventional Title 5 system.

TABLE 2-1
TOWN OF NANTUCKET
CWMP/FEIR
SUMMARY OF MONITORING RESULTS VERSUS TREATMENT REQUIREMENTS

I/A TECHNOLOGY	Average Monitoring Results						DEP Treatment Requirements					
	BOD_5		TSS		Total Nitrogen		BOD_5		TSS		Total Nitrogen	
	Effluent Concentration (mg/L)	Percent Removal (%)	Effluent Concentration (mg/L)	Percent Removal (%)	Effluent Concentration (mg/L)	Percent Removal (%)	Effluent Concentration (mg/L)	Percent Removal (%)	Effluent Concentration (mg/L)	Percent Removal (%)	Effluent Concentration (mg/L)	Percent Removal (%)
Recirculating Sand Filter							30	85	30	85	25	40
Colburn Street - Gloucester, MA	7.0	96.5	12.0	82.3	60.8	39.2						
Langsford Street - Gloucester, MA	11.0	93.3	15.0	77.0	78.6	44.6						
Anne Arudel County - Maryland												
System A	4.0	98.1	8.0	88.9	22.0	59.3						
System B	2.0	98.4	5.0	91.1	17.0	62.2						
System C	8.0	97.8	10.0	89.7	21.0	70.4						
Chart House Restaurant - Chester, CT	4.0	99.1	7.0	96.5	11.9	73.5						
Amphidrome Process							30	85	30	85	Residential -- 19	55
Stuart's Mall - Swansea, MA	9.2	95.0	9.9	68.5	14.5	67.5					Nonresidential -- 25	40
											Goal – 10	76
Bioclere							30	85	30	85	Residential -- 19	55
High Street - Gloucester, MA	29.0	78.4	33.0	62.3	26.9	39.8					Nonresidential -- 25	40
Vale Court - Gloucester, MA	51.0	83.6	42.0	66.3	29.3	47.4						
NSF Testing	13.0	82.4	17.0	63.8	22.3	20.5						
391 Atlantic Avenue - Cohasset. MA	7.3	87.6	8.9	64.0	12.3	11.1						
Stop & Shop - Yarmouth, MA	112.0	81.1	86.0	50.4	43.7	35.3						
Mercury Drive - S. Yarmouth, MA	50.0	63.9	79.0	63.5	24.0	21.7						

TABLE 2-1 (cont)
TOWN OF NANTUCKET
CWMP/FEIR
SUMMARY OF MONITORING RESULTS VERSUS TREATMENT REQUIREMENTS

I/A TECHNOLOGY	Average Monitoring Results						DEP Treatment Requirements					
	BOD_5		TSS		Total Nitrogen		BOD_5		TSS		Total Nitrogen	
	Effluent Concentration (mg/L)	Percent Removal (%)	Effluent Concentration (mg/L)	Percent Removal (%)	Effluent Concentration (mg/L)	Percent Removal (%)	Effluent Concentration (mg/L)	Percent Removal (%)	Effluent Concentration (mg/L)	Percent Removal (%)	Effluent Concentration (mg/L)	Percent Removal (%)
Cromaglass							30	85	30	85	Residential -- 19	55
Meadowbrook Christian School -- Milton, PA											Nonresidential -- 25	40
Phase I	11.1	92.1	19.2	86.2	12.9	29.7					Goal – 10	76
Phase II	7.5	95.8	11.9	93.1	4.7	78.7						
NSF Testing	42.0	82.3	39.0	84.2	--	--						
RUCK							30	85	30	85	Residential -- 19	55
Highway Inspection Facility -- Truckee, CA	9.7	80.9	--	--	60.3	57.0						
Porter's Orchard Lot No. 5 -- Colchester, VT	51.2	75.7	156.0	48.2	142.7	27.5						
Porter's Orchard 8 Home Composite	47.8	--	63.1	--	5.7	--						
Single Home FAST							30	85	30	85	Residential -- 19	55
NSF Testing	9.0	93.8	7.0	96.4	9.3	73.2					Nonresidential -- 25	40
Florida Keys -- Owners Demonstration	4.6	95.7	8.0	92.2	13.0	64.5					Goal – 15	64
140 Beach Street -- Cohasset, MA	20.1	--	6.2	--	12.2	--						
Coonamesett Inn -- Falmouth, MA	14.8	--	18.5	--	6.6	--						

I/A technologies can potentially overcome site and environmental constraints but at a premium cost to the property owner. In remedial situations, I/A technologies with nitrogen reduction allow for either a 50 percent reduction in leaching area; a two foot reduction in the groundwater separation requirement; or a two foot reduction in the depth of naturally occurring soil under the leach field. Since the treatment capabilities as well as the cost of the I/A technologies are similar, one technology, Single Home FAST® System, was selected in order to evaluate the wastewater disposal alternatives for the areas of wastewater disposal needs. The costs of the I/A technologies are similar and all are capable of achieving enhanced treatment over that of a conventional Title 5 system.

3. Analysis of On-site Alternatives

General

A brief on-site alternatives analysis to determine the optimal wastewater treatment and disposal options for the areas of wastewater disposal needs is presented below. The analysis considers each of the need areas as a single entity. To determine the optimal wastewater treatment and disposal option for each need area, technical and environmental factors were considered. The purpose of this evaluation is to determine which of the on-site, cluster, and/or I/A options presented are feasible, if any, for the ten (10) wastewater disposal Need Areas identified in Nantucket.

Conventional Title 5 Septic Systems

Conventional Title 5 septic systems would be a feasible option if all the existing developed properties within the Need Areas are capable of siting a soil absorption system according to Title 5 code. Without conducting site specific field investigations for each property in each of the need areas, and based solely on the subsurface soil and groundwater information gathered from Board of Health data, it is anticipated that some of the identified need areas will not be able to meet Title 5 regulations for the soil absorption system and pose a greater risk to the environment in other areas. Thus, continued use of existing and use of conventional Title 5 septic systems are not considered feasible for all of the need areas identified in the Phase I Document.

Variances to Conventional Title 5 Septic Systems

Conventional Title 5 septic systems with a variance would also be a feasible option if all of the existing developed properties within the need areas were capable of siting a soil absorption system with either a variance from the Title 5 regulations or Town By-law. The criteria used to determine whether variances to conventional Title 5 systems are feasible for a need area are: lot size, soils, and groundwater. If the need area has an average lot size of less than or equal to one-half acre but does not have either severe soil or groundwater limitations, the area could potentially use variances to conventional Title 5 systems. If a need area has an average lot size less than or equal to one-half acre with either severe soil or groundwater limitations, then variances to conventional Title 5 systems are not an option. Since all the properties within the need areas are not larger than one-half acre in size, Title 5 systems with variances are a potential option for a portion of each of the need areas, but not for all of each of the identified need areas. Hence, this is not a feasible option for an entire need area. Each property would need to be evaluated on a case-by-case basis in order to determine which properties could effectively utilize Title 5 systems with variances. This option will be evaluated in those Needs Areas recommended for long-term sustainable with on-site wastewater disposal systems and managed under a Septage Management Plan.

STEP/Cluster Systems

STEP/Cluster systems would be a feasible option if a soil absorption system can be sited within the area of wastewater disposal need or within close proximity to the need area. The STEP/Cluster System consists of a septic tank effluent pump on each property and a small scale, off-site subsurface cluster disposal system. The disposal system for this type of facility is similar to a conventional Title 5 soil absorption system, except that it is larger in scale and is located off-site from the wastewater source. As previously discussed, at a minimum, approximately 0.4 acres are required for the disposal system, assuming good soils and not including setback requirements from property lines, wells, etc. If reasonable setback limits are included, 0.6 acres is typically required for the disposal system.

The disposal system could be located either on an undeveloped parcel in the need area, on an undeveloped parcel just outside of the need area, or on a portion of an existing developed parcel in the need area. The property would need to be either purchased by the Town or an easement on the existing property would need to be obtained from the property owner by the Town. It is unlikely that a property owner would be willing to sell a portion of their property or grant an easement on their property to site a subsurface disposal system. In addition, there would need to be enough area on the property with adequate soils, depth to groundwater, depth of naturally occurring soil, and depth to ledge to accommodate such a system. One of the major limiting factors in the Needs Areas is insufficient land area so, thus STEP / Cluster systems are most likely not a viable option for wastewater treatment and disposal in the identified areas of wastewater disposal need.

On-site Innovative Alternative Wastewater Treatment and Disposal Systems

On-site Innovative/Alternative (I/A) systems would be a feasible option if the existing developed properties could accommodate innovative alternative systems (e.g. recirculating sand filter, Amphidrome™ Process, Bioclere™ System, Single Home FAST, etc.) to effectively treat and dispose of wastewater. Like a conventional Title 5 system, these I/A systems require a soil absorption area. As previously mentioned, an I/A system can potentially overcome site and environmental constraints but at a premium cost to the property owner. In remedial situations, I/A technologies with nitrogen reduction allow for either a 50 percent reduction in leaching area; a two foot reduction in the groundwater separation requirement; or a two foot reduction in the depth of naturally occurring soil under the leach field. If a property has either severe soil limitations or high groundwater, the area could potentially use I/A wastewater treatment and disposal systems. However, if a property has both severe soil limitations and high groundwater, then I/A wastewater treatment and disposal systems are not an option. I/A systems will be considered in those Needs Areas that can accommodate such systems and will be offered as a recommendation if appropriate in order to comply with the recommendations of the Estuary project. This option will also be included in the development of the Island-wide septage management planning.

4. Configurations and Alternative Sewer Systems

Gravity Sewer System

A gravity sewer system consists of sewer lines that allow residential, commercial, and industrial customers to discharge into a sanitary system consisting of gravity pipes, which flow downhill and are not pressurized. Gravity sewer systems operate by collecting the wastewater via continuously sloped pipe, typically eight inches minimum diameter, and transport the wastewater to local low points in the collection system. The design of a gravity sewer system is dependent on the velocity of the wastewater within the pipes. Minimum velocities are set to assure that suspended matter does not settle out in the conduit, while maximum velocities are set to prevent erosion of pipe material. Extremely flat or hilly terrain poses problems to gravity sewer installation since the gravity sewers must continually slope downward. This results in the sewer becoming increasingly deep or the need for a pump station. Pump stations are located at the local low points to collect and pump the wastewater to the next high point in the collection system, where the process continues.

Low Pressure Sewer System

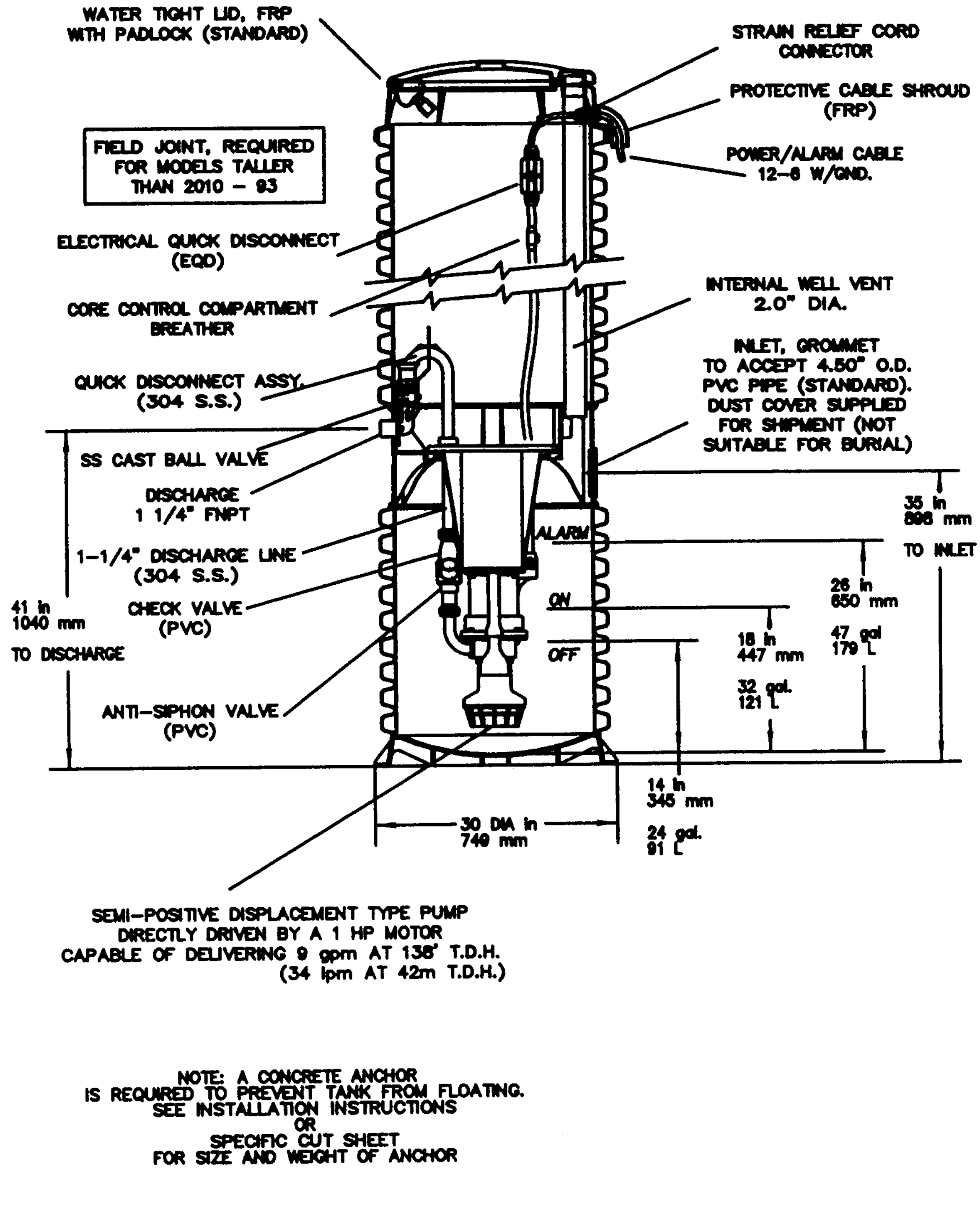
A low-pressure sewer system has proven to be a viable alternative to gravity sewer systems. A low-pressure sewer system includes small diameter pressure sewers fed by individual grinder pumps at each source or can be configured so that the pump system may also serve multiple sources. A pressure sewer system makes use of small diameter piping, ranging in size from 1-¼ to 4 inches in diameter, buried at a shallow depth following the profile of the ground. The pressure main and service pipe are generally manufactured from polyvinyl chloride (PVC) or high density polyethylene (HDPE). The pressure sewer mains and laterals are buried just below the depth of frost penetration following the contour of the ground.

The pressure sewer system is separated into branches of sewers of different sizes depending on the number of connections to each branch. Standard manholes are not required in a pressure sewer system. Instead, flushing connections/drain manholes are installed at the end of branches and where major changes in direction or size of pipe occurs. Air relief/vacuum valve manholes are installed at high points in the system to allow trapped air to escape. Each source will utilize a grinder pump for discharge of sewerage into the main. Each grinder pump unit is equipped with a grinder pump, check valve, tank and all necessary controls. The units can be located outdoors close to each source's existing septic tank or cesspool so that the connection to the existing service pipe exiting the building can be made easily. The units can also be located inside the building. The grinder pump macerates the solids present in the wastewater to a slurry in a manner that is similar to a kitchen sink garbage grinder and discharges wastewater to the pressure sewer collection pipes. If a malfunction occurs, a high liquid level alarm is activated. This alarm may be a light mounted on the outside of the building or an audible alarm, which can be silenced by the customer. The customer will then notify the Town or a Town approved technician or contractor to come and make the necessary repair. Figure 2-10 shows a schematic of a typical grinder pump unit.

A low-pressure sewer system collects and transports the wastewater from each customer located in low points to the nearest gravity sewer. Each customer would provide the service pipe from their building to the grinder pump, the grinder pump, and service pipe to the property line. The Town would provide the service pipe and appurtenances from the property line to the low-pressure sewer. Within the right-of-way, air relief manholes with air and vacuum valves would be installed at all high points and terminal flushing drain manholes would be installed at all low points. In addition, cleanouts would be installed every 1,000 feet. As an option the Town may consider to purchase and install the grinder pump units within the roadway right-of-way.

Vacuum Sewer System

Like the low-pressure sewer system, the vacuum sewer system is used where gravity sewer systems are impractical and/or not economically feasible. The vacuum collection system consists of three main components: (1) services, (2) collection mains, and (3) the vacuum station. As with pressure sewers, the materials used for the collection mains and service pipe are typically PVC or HDPE. The pipe diameter for the collection mains range from a minimum of 4 to 10 inches. The service lines have a minimum diameter of 3 inches. The service lines consist of a vacuum valve, auxiliary vents, valve pit/sump or buffer tank. The valve pit/sump accepts the waste from the customer. Included within the valve pit is a vacuum valve, which provides the interface between the vacuum in the collection piping and the atmospheric air in the building sewer, and a controller, which regulates the vacuum cycle frequency.



SOURCE: ENVIRONMENT ONE CORPORATION

Figure 2-10
Typical Grinder Pump Unit

When the vacuum valve is closed, system vacuum within the collection piping is maintained; when it is open, the system vacuum evacuates the contents of the sump. An auxiliary vent is installed on the customer's service lateral and is necessary to provide the volume of air that will follow the wastewater into the main. Buffer tanks are also used as holding tanks to collect and regulate large flows such as those flows from apartment buildings, schools and other large users, and are required when gravity flow switches to vacuum flow.

Vacuum systems can be buried at a shallow depth due to the high velocity (15 to 18 feet per second) of sewage, which keeps the lines from freezing. The collection mains can follow the profile of the ground as long as there are small elevation changes. The collection lines need to have a minimum slope of 0.2 percent toward the vacuum station. Uphill liquid transport or temporary increases in elevation can be accomplished by the insertion of lifts (vertical profile changes) along the sloped route to the station. These lifts can consist of two 45-degree elbows connected by a straight piece of pipe and are limited to a length of three feet. The collection mains are all connected to a vacuum station located in the center of the service area. The vacuum created by the system pulls sewage to the vacuum station and pumps it to its ultimate disposal point in the downstream collection system. This station has a collection tank and a vacuum tank. The wastewater is stored in the collection tank until a sufficient volume accumulates and it is then evacuated. In addition to the collection and vacuum tanks, the vacuum station includes: vacuum pumps to create the vacuum for wastewater transport; wastewater pumps to transfer the wastewater which is pulled into the collection tank by the vacuum pumps to the disposal point in the downstream collection system; controls; motor control center; chart recorder; and a fault monitoring system to alert the operator of irregularities such as low vacuum levels. Therefore, the vacuum station requires an electrical connection, however, electrical connections at each user are not necessary. A standby generator is required for this station so that the system can continue to operate in the event of a power failure.

5. Wastewater Treatment, Disposal, Reuse and Land Applications

As previously discussed, alternatives were presented for discharge of sewage from Nantucket's need areas to various decentralized facilities. In this section, the alternative of treating Nantucket's sewage at a new wastewater treatment facility, at the Siasconset Wastewater Treatment Facility that is currently under construction, and/or at the Surfside Wastewater Treatment Facility was explored. The alternative required a detailed look at process requirements, cost impacts, land requirements, structure sizing, treatment ability, as well as, looking into the existing treatment facilities and disposal systems capacities.

In general, the new treatment facility alternative consists of providing an appropriate level of sewerage treatment that allows treated effluent discharge on the Island of Nantucket. As such, the treatment technologies analyzed must be capable of producing an effluent that meets DEP criteria. The following issues were discussed in this section: (1) Effluent discharge options; (2) Proposed effluent limitations; (3) Four general treatment categories: suspended growth biological process, fixed film biological processes, physical/chemical processes and natural systems processes; (4) Existing Surfside and Siasconset wastewater treatment facilities; (5) Evaluation criteria; and (6) Potential Reuse Opportunities.

The treatment categories and technologies described in this section do not represent all of the treatment processes necessary only the central processes which accomplish most of the treatment needed to meet proposed effluent limitations. It is assumed that all treatment technologies will need preliminary screening of large objects, grit removal and disinfection. The need for primary clarification will depend on the specific technology involved, but it is assumed that many will require it. These issues will be addressed in detail once the treatment technologies have been screened.

Effluent Discharge Options

Surface Water Discharges

The discharge of treated wastewater to surface waters was evaluated as an option for disposal in Nantucket. Surface waters also include wetland areas adjacent to streams and waterbodies. This disposal option involves discharging highly treated effluent from a treatment facility directly to a surface water body, stream or wetland system. For purposes of this discussion, the location of the discharge is considered independent of the location of the treatment facility since the treated effluent could be transmitted along a pipeline.

The discharges of pollutants to surface waters is regulated by DEP under the Surface Water Discharge Permit Program (314 CMR 3.00) and the Massachusetts Clean Water Act (MGL c.21, s.26-53). The point source discharge of pollutants is regulated by the National Pollutant Discharge Elimination System (NPDES) permit program administered by the EPA under Section 402 of the Clean Water Act. EPA is the lead agency in NPDES permitting using compliance with water quality standards set under the DEP state Surface Water Discharge Permit Program (314 CMR 3.00). The DEP cosigns the issued permit, if it is determined that water quality standards will be met, a 401 Water Quality Certificate is issued.

The Surface Water Discharge and NPDES Permit Program have been established to limit or prohibit discharges of pollutants to surface waters to assure that surface water quality standards of receiving waters are protected, maintained or attained. The antidegradation provision of the Surface Water Quality Standards (314 CMR 4.04) requires that in all cases existing uses shall be maintained and protected.

The Massachusetts Division of Marine Fisheries designates the following surface waters and harbors in Nantucket as shellfish growing areas:

Polpis Harbor	Sesachacha Pond
Nantucket Harbor West and East	Nantucket Southeast Coastal
Head of the Harbor	Madaket Harbor
Coskata Pond	Northwest Coastal
Nantucket East Coastal	Nantucket Northeast Coastal
Nantucket Southwest Coastal (Hummock Pond and Clark Cove)	

The effluent parameter of concern for a surface water discharge is phosphorus, which, even at relatively low concentrations, can increase the growth of aquatic plants, and produce algal blooms. Such conditions reduce the aesthetic and recreational utility of receiving waters. Lakes, ponds, and small or slow moving streams are most sensitive to increases in phosphorus and other nutrient loadings, due to their low flow through rates. Table 2-2 outlines the minimum criteria for Class B waters, the anticipated designation of receiving waters, as well as additional minimum criteria for surface waters.

Although EPA has stated that discharges to local surface waters should be considered, they have expressed concerns that the local surface waters provide little or no dilution. The larger surface waterbodies and streams in Nantucket include: Sesachacha Pond, Long Pond, Tom Nevers Pond, Miacomet Pond, Coskata Pond, Hither Creek, and Gibbs Pond.

In addition, the larger harbors include: Nantucket Harbor, and Madaket Harbor. These surface water bodies are either insufficient in size, predisposed to seasonal flooding, suffering from poor water quality, used for recreational purposes or their locations limit their use. The harbors are used for shellfish harvesting, which would represent an incompatible use. In addition, it is doubtful that the U.S. Environmental Protection Agency and/or Massachusetts Department of Environmental Protection would approve a surface water discharge for Nantucket, as the waterways have already experienced declining water quality due to elevated nutrient levels. As such a surface water discharge to these ponds and harbors is not being considered further. The two existing wastewater treatment facilities on the Island discharge to rapid infiltration basins.

As was previously stated in this Phase II Document, the stringent regulatory requirements facing the surface water discharge and the unavailability of suitable surface waters on Island preclude this disposal option as a reliable alternative and therefore a detailed evaluation of this discharge option has not been developed for this document. Additionally, as was previously discussed in the preceding section, the Massachusetts Ocean Sanctuaries Act prohibits discharge of municipal wastewater off Nantucket. The only purpose of presenting any type of surface water discharge in this document is to address the opportunities and constraints associated with wastewater disposal.

TABLE 2-2
TOWN OF NANTUCKET
CWMP/FEIR
SUMMARY OF WATER QUALITY CRITERIA FOR CLASS B STREAMS

CLASS B WATERS (Minimum Criteria)	Description
Dissolved Oxygen	Shall not be less than 6.0 mg/L in cold water fisheries and 5.0 mg/L in warm water fisheries
Temperature	Shall not exceed 68°F in cold water fisheries and 83°F in warm water fisheries
pH	Shall be in a range of 6.5 through 8.3 standard units and not more than 0.5 units outside of the background range
Fecal Coliform Bacteria	Shall not exceed the geometric mean of 200 organisms per 100 ml, not shall mare than 10 percent of samples exceed 400 organisms per 100 ml
Solids	Free from floating, suspended and settleable solids
Color and Turbidity	Free from color and turbidity in concentrations or combinations that are objectionable
Oil and Grease	Free from oil , grease and petrochemicals that produce a visible film on the surface of the water, impart an oily taste
Taste and Odor	None in such concentrations or combinations that are aesthetically objectionable
Additional Minimum Criteria for All Surface Waters	All surface waters shall be free from pollutants in concentrations or combinations that settle to form objectionable deposits, float as debris, scum or other matter to form nuisances
Bottom Pollutants or Alterations	All surface waters shall be free from pollutants in concentrations or combinations, or from alterations that adversely effect the physical or chemical nature of the bottom
Nutrients	Shall not exceed site-specific limits necessary to control accelerated growth of algae and other plants.
Radioactivity	Free from radio-active substances in concentration or combinations that would be harmful
Toxic Pollutants	Free from pollutants in concentrations or combinations toxic to humans, aquatic life or wildlife

Groundwater Discharges

The discharge of treated wastewater to groundwater was evaluated as an option for disposal in Nantucket. This disposal option involves the discharge of highly treated effluent from a wastewater treatment facility into an infiltration bed designed to handle the estimated discharge. For discussion purposes, the location of the discharge is considered independent of the location of the treatment facility since the treated effluent could be transmitted along a pipeline to the infiltration system.

The requirements for groundwater discharge of wastewater are outlined in the Groundwater Discharge Permit Program (314 CMR 5.00 and 6.00). The principal constituent of concern for groundwater discharges is nitrates, a primary component of treated wastewater. Potential sites for use as a groundwater disposal site must be comprised of sandy or gravely soils that exhibit medium infiltration rates. Sites that contain poor soil permeability, high groundwater levels, and ledge, inhibit the downward flow of water and are generally unacceptable. Soil properties can be amended by excavating and amending the soils in the discharge area or mounding the infiltration beds. This approach may be infeasible for larger systems designed for large wastewater flows but may be appropriate for small systems.

The most difficult of these physical constraints to overcome is the shallow depth to bedrock. Title 5 requires that 4 feet of naturally occurring pervious material be located beneath the bottom of the leaching facility. In areas where bedrock is 4 feet or less from the natural ground surface, a system cannot be installed in accordance with Title 5. Soils with slight or moderate limitations for wastewater disposal are considered acceptable for effluent beds. The groundwater discharge options within Nantucket are also restricted by discharge standards that prohibit anti-degradation. The Nantucket County Soil Survey Report by the U.S. Department of Agriculture indicates that soil classifications having severe soil limitations to septic disposal represent approximately 14.2 percent and the soil classifications having severe groundwater limitations to septic disposal represent approximately 18.3 percent of the total land are of Nantucket.

Proposed Effluent Limitations

Effluent limitations are dependent upon the method and location of treated effluent discharge. As discussed above, there are two ultimate effluent discharge options: surface water and groundwater discharge. A surface water discharge would involve discharging treated effluent to a stream, pond, lake or wetland area. A groundwater discharge would involve the discharge of treated effluent to the ground and percolation through the soil to the groundwater. Groundwater discharge can be accomplished by discharging the treated effluent to rapid infiltration sand basins; using spray irrigation or overland discharge; or to subsurface disposal beds similar to Title 5 septic systems. Another groundwater discharge method would be to utilize subsurface injection through wells.

A stream, pond or lake surface water discharge was determined to be infeasible in Nantucket because of the more stringent effluent requirements associated with small, intermittent low flow streams and primarily groundwater fed ponds. While a properly sited system with highly treated effluent discharged to a surface water body through a constructed wetland offers a high degree of treatment, it likely will not be able to meet water quality requirements regarding metals where there is little or no dilution. Accordingly, surface water discharges have been eliminated from further consideration.

For Nantucket, it was determined that groundwater discharge would be the most feasible means of effluent discharge. The requirements for groundwater discharges can be found in 314 CMR 5.00. According to these regulations, the minimum effluent limitations for a Nantucket treatment facility are shown in Table 2-3.

Beneficial reuse of wastewater typically is associated with the application and reuse of water for irrigation. In this context reuse also applies to discharging treated wastewater into the ground to recharge the aquifer used for supplying drinking water. The technology exists, through the use of micro-filtration and membrane technologies, if necessary, to produce very clean effluent to meet most reuse needs.

Reuse of the wastewater effluent as seasonal irrigation at golf courses could reduce water use at the course as well as minimize the summer loadings to adjacent waterbodies during the critical spring-to-fall growing season.

TABLE 2-3
TOWN OF NANTUCKET
CWMP/FEIR
PROPOSED EFFLUENT LIMITATIONS

Parameter	Open Beds Proposed Limits (1)	Subsurface/Spray Irrigation Proposed Limits (2)
Biochemical Oxygen Demand (BOD_5)	30 mg/L	10 mg/L
Total Suspended solids (TSS)	30 mg/L	10 mg/L
Total Nitrogen	10 mg/L	<10 mg/L
Fecal Coliform	200 mpn/100 ml	200 mpn/100 ml
Oil and Grease	15 mg/L	15 mg/L

(1) 314 CMR 5.00
(2) Proposed limits for subsurface disposal to prevent plugging of disposal area and to eliminate the need for a reserve area.
Note: mg/L = milligrams per liter; mpn/100 ml = most probable number per 100 milliliters

This irrigation reuse is considered a secondary disposal option since a permanent effluent disposal solution will still be required in the off months when the golf courses are not operating. A more detailed discussion of Reuse follows in this section. DEP's opinion is that a properly planned and sited discharge that has received a high level of treatment can be sited in a Zone II and still protect the environment and public health, although DEP strongly recommends that discharges of highly treated wastewater to the groundwater outside of a Zone II be considered first.

Based on the Interim Guidance on Reclaimed Water Use issued by DEP (Draft, September 1, 1998), new discharges from wastewater treatment plants within aquifer recharge areas (Zone IIs) must meet the discharge and treatment standards as shown in Table 2-4. These standards apply to the reclaimed water at the point of discharge from the treatment facility, unless otherwise noted. Siting a wastewater disposal site within a Zone II is normally a prohibited use unless all other feasible alternatives have been explored. The EPA New England Region has expressed concerns regarding the groundwater discharge of wastewater within the Zone II. The concerns expressed by the EPA include the reliability of the treatment facilities and adequacy of the water supply monitoring programs for detecting potential health risks associated with contaminants in the wastewater. Based on these concerns, EPA is not recommending discharge within a Zone II as a preferred option.

TABLE 2-4
TOWN OF NANTUCKET
CWMP/FEIR
CLASS 1 GROUNDWATER PERMIT STANDARDS

Parameter	Standard
pH	6 to 9
BOD	$\leq$ 10 mg/L or $\leq$ 30 mg/L
Turbidity	$\leq$ 2 NTU or $\leq$ 5 NTU
Fecal Coliform	median of 0 colonies/100 ml over continuous, running 7 day sampling periods, not to exceed 14/100 ml or 200 colonies/100 ml
TSS	5 mg/L or 10 mg/L
Total Nitrogen	< 10 mg/L

Required Land Areas

The land area required for each alternative is the sum of the area required for the actual treatment facility and the area required for effluent disposal. The land area required for the actual facility is dependent upon the size of the treatment plant as well as the treatment technology chosen. This is a highly variable parameter, thus it will be discussed in general in the following subsection (Treatment Technologies and Evaluation Criteria) as it relates to the specific technologies, which will be defined more precisely in the screening process and subsequent detailed analyses of the prospective alternatives.

Land areas required for effluent disposal are dependent upon the soil characteristics of the site and the method of disposal. Effluent disposal can be achieved through surface or subsurface application. Table 2-5 and Table 2-6 include approximate land area requirements for surface and subsurface disposal assuming a percolation rate of 5 to 10 minutes per inch and an application rate of 4 and 2.5 gallons per day/square feet, respectively. These areas will have to be tailored to the specific facility and site once screening is complete and soil characteristics have been determined.

TABLE 2-5
TOWN OF NANTUCKET
CWMP/FEIR
AREAS REQUIRED FOR SURFACE APPLICATION
OF TREATED EFFLUENT

Surface Application (Open Sand Beds) Application Rate: 4 gpd/ft^{2}(1)						
Average Daily Flow	Leaching Area		Reserve Area		Total Area	
gpd	ft^2	Acres	ft^2	Acres	ft^2	Acres
200,000	50,000	1.15	50,000	1.15	100,000	2.30
400,000	100,000	2.30	100,000	2.30	200,000	4.59
600,000	150,000	3.44	150,000	3.44	300,000	6.89
800,000	200,000	4.59	200,000	4.59	400,000	9.18
1,000,000	250,000	5.74	250,000	5.74	500,000	11.48

(1) Based on recommendations in the “Guidelines for the Design, Construction, Operation, and Maintenance of Small Sewage Treatment Facilities with Land Disposal.”

TABLE 2-6
TOWN OF NANTUCKET
CWMP/FEIR
AREAS REQUIRED FOR SUBSURFACE APPLICATION
OF TREATED EFFLUENT

Surface Application (Open Sand Beds) Application Rate: 2.5 gpd/ft^{2}(1)						
Average Daily Flow	Leaching Area		Reserve Area		Total Area	
gpd	ft^2	Acres	ft^2	Acres	ft^2	Acres
200,000	44,600	1.02	133,200	3.06	177,800	4.08
400,000	89,000	2.04	266,400	6.12	355,400	8.16
600,000	133,400	3.06	399,600	9.17	533,000	12.23
800,000	177,800	4.08	532,800	12.23	710,600	16.31
1,000,000	222,400	5.11	666,600	15.30	889,000	20.41

(1) Based on recommendations in the “Guidelines for the Design, Construction, Operation, and Maintenance of Small Sewage Treatment Facilities with Land Disposal”.
(2) According to the “Guidelines,” the area between the leaching facilities can be used as the reserve area.

Treatment Technologies

In this section, a total of 14 treatment technologies are described. These treatment technologies discussed can be broken down into four broad categories as follows:

- **Suspended Growth Biological Processes**

  Conventional Activated Sludge/Extended Aeration
  Pure Oxygen Activated Sludge
  Sequencing Batch Reactors
  Oxidation Ditch
  A/O Systems

- **Fixed Film Biological Processes**

  Trickling Filters
  Rotating Biological Contactors
  Activated Biofilters

- **Physical/Chemical Processes**

  Chemical Coagulation
  Granular Activated Carbon
  Zimpro PACT

- **Natural Systems Processes**

  Aquaculture
  Constructed Wetlands
  Solar Aquatics™

The 14 wastewater treatment alternatives listed above are described in the following paragraphs:

Suspended Growth Biological Treatment

Suspended growth treatment is a biological process that consists of microorganisms in suspension feeding on organic pollutants in the wastewater. This process is accomplished aerobically and therefore outside air is added. The added air serves two purposes in that it provides microorganisms with their needed supply of oxygen and also maintains the suspension of biomass. Within the suspended growth biological processes category, a total of five alternatives will be considered. These treatment alternatives do not need to be proceeded by primary treatment units in order to meet the proposed BOD_5 and TSS effluent requirements. Suspended growth processes are capable of producing an effluent that meets 10 mg/L BOD_5, 10 mg/L TSS, 19 mg/L NO_3 and 1 mg/L NH_3.

Conventional Activated Sludge/Extended Aeration

In the Conventional Activated Sludge (CAS) process, treatment is accomplished by microorganisms in suspension. The process usually consists of a rectangular shaped aeration tank and a final clarifier that separates out the biomass for either wasting or recycling. Since in colder climates, an older sludge age is required to achieve the required BOD_5 effluent levels, extended aeration, which is a variation of the activated sludge process, is commonly used. With extended aeration, aeration time is up to 4 times longer than with the typical CAS system. Using longer aeration times allows the facility to operate over a wider range of flows and loads. However, such systems are usually limited to relatively low organic loads and therefore are generally applicable to flows less than 1 MGD. Sludge generated in the process is recycled and aerobically digested; therefore, very little sludge is wasted compared to the typical CAS system. The extended aeration system achieves better than secondary levels of treatment and can generally reduce BOD_5 and TSS to 10 mg/L, NO_3 to 19 mg/L and NH_3 to 1 mg/L. Some biological nitrogen removal occurs as a consequence of periodic high waste load-low oxygen and low wasteload-high oxygen cycles creating a suitable environment for the appropriate bacteria. However, it is not anticipated that the levels of total nitrogen removal required will be achieved without modification of the normal extended aeration process or without additional treatment processes.

Although CAS/Extended Aeration Systems have been used successfully in this country for over 70 years and it has been proven to be a flexible and reliable process which produces year-round secondary treatment quality effluent, it has been known to require relatively complex process monitoring and control, and the process is subject to shock loadings and solids washout during flow surges. Another drawback of the process is that it produces a sludge that is difficult to thicken and dewater. Perhaps a more serious drawback to the use of this treatment technology is that without added treatment units, the process cannot reliably reduce nitrogen to required levels. This is an issue when considering groundwater discharge. Climate is also an issue because extended aeration cycles in cold weather hinder treatment performance. The use of extended aeration may also have regulatory and legal implications because of its inability to meet required effluent limitations.

Construction and operation costs for CAS/Extended Aeration are usually not especially high, although operation costs are higher than other treatment processes because of the relatively complex operational requirements. Electric power usage of Extended Aeration facilities tend to be high as a result of long aeration times and therefore these facilities generally have higher operation costs.

Pure Oxygen Activated Sludge

Pure Oxygen Activated Sludge is a variation of CAS in which pure oxygen is added to the aeration tank rather than air. Pure oxygen systems are used when it is an advantage to keep aeration tank volumes and sizes small. Pure oxygen activated sludge tanks are smaller (about one third (1/3) the volume) than CAS tanks because more oxygen is available and therefore less time and volume are needed to degrade organic pollutants. Due to the smaller footprint size, this process is commonly used for treatment facilities with severe site constraints. Like CAS/extended aeration systems, pure oxygen systems achieve better than secondary levels of treatment and can generally reduce BOD_5 and TSS to 10 mg/L, NO_3 to 19 mg/L and NH_3 to 1 mg/L. The pure oxygen process is not capable, however, of reducing total nitrogen to required levels without additional treatment processes.

Pure Oxygen Activated Sludge has many of the same benefits and drawbacks as the CAS Process. The capital costs are about the same: the savings due to the smaller tankage are comparable to the additional costs of the sophisticated oxygen generation equipment. Additional drawbacks of Pure Oxygen Activated Sludge are that it tends to cost more to operate than CAS due to the oxygen required. The principle consideration, here and with CAS/extended aeration, is the inability of the process to reliably reduce nutrients to required levels.

Sequencing Batch Reactors

Sequencing Batch Reactors (SBR's) are a variation of activated sludge biological treatment. In the SBR process, the mixing, aeration and settling takes place in one basin, not in separate basins typical of CAS processes. SBR's operate on a fill-and-draw principle in which wastewater flows into a basin and is mixed and aerated using mechanical and/or diffused aeration. When a basin is full, flow is diverted to a parallel basin while mixing and aeration continues in the full basin. After a period of time, mixing and aeration is stopped and the tank contents are allowed to settle. Excess sludge is removed from the bottom of the tank while the treated effluent is decanted from the top. The SBR process achieves better than secondary levels of treatment and can generally reduce BOD_5 and TSS to 10 mg/L, NO_3 to 19 mg/L and NH_3 to 1 mg/L. An added advantage of the SBR process is that nitrogen can be reduced to required levels without additional equipment and tankage. If the SBR is run with an anoxic cycle, it can reduce total nitrogen to 10 mg/L. If phosphorus removal is required, the SBR process can be run with both an anaerobic cycle and anoxic cycle reducing the phosphorous levels to about 1.5 mg/L.

The Sequencing Batch Reactor is used in relatively low flow, space-limited applications. A particular advantage of the SBR is that it can handle shock and variable flow and load. Another advantage of the SBR is that no secondary clarifiers are required. There may be some community acceptance issues as a result of the relatively large tankage involved with the SBR process. The SBR combines the settling and aeration steps into one tank that limits the size of the footprint of the facility. SBR's can be built above-ground with exposed tank walls or can be constructed at grade level depending on the terrain of the site. The above-ground tankage is a possible aesthetic concern. Enclosing the above-ground tankage in a building is an option; however, it would drive the cost of the SBR alternative up.

Oxidation Ditch

The oxidation ditch is a variation of the extended aeration process in which oxygen is imparted to the wastewater through mechanical surface aerators. In the other types of suspended growth systems described so far, the oxygen is usually provided by diffused aeration. The oxidation ditch is characterized by its distinctive "race track", oval shape. Like extended aeration, the oxidation ditch achieves better than secondary levels of treatment and can generally reduce BOD_5 and TSS to 10 mg/L, NO_3 to 19 mg/L and NH_3 to 1 mg/L. The oxidation ditch is not capable, however, of reducing total nitrogen to required levels without additional treatment processes.

An oxidation ditch is a special type of extended aeration process, and as a result, its utilization will raise many of the criteria issues raised with CAS/extended aeration. The only notable difference is the configuration used and community acceptance issues that might surface as a result. The "race track" type configuration employed takes up more space than typical extended aeration layouts. The larger space required would cost more to purchase land and to build, and the layout does not lend itself well to a building enclosure. Residents in the area may find a large, unenclosed "race track" shape in their area unsightly.

Anaerobic/Anoxic/Oxic Systems

For the purposes of this report, Anaerobic/Anoxic/Oxic Systems are defined as those processes that utilize a combination of anaerobic, anoxic and oxic (aerobic) stages to reduce nitrogen and phosphorus. The removal of nitrogen occurs in a two step process. The first step is done aerobically and involves the biological oxidation of ammonia-nitrogen to nitrate-nitrogen. The second step is done in an anoxic basin and reduces nitrate-nitrogen to nitrogen gas. The first step is known as nitrification and the second step is known as denitrification.

Systems designed to remove nitrogen, A/O Systems, generally consist of an anoxic stage followed by an aerobic stage, and a final clarifier that recycles settled sludge to the anoxic zone. Nitrification occurs in the aerobic zone and denitrification occurs in the anoxic zone. The anoxic zone is strategically placed ahead of the aerobic zone in order to take advantage of influent organics that aid in denitrification. The A/O System can generally reduce BOD_5, TSS and Total Nitrogen to 10 mg/L.

A variation of this process is the A^2O^2 process that consists of four sequential stages: an anoxic stage, aerobic stage, anoxic stage, and aerobic stage. This A^2O^2 process can reduce BOD_5 and TSS to 10 mg/L, and Total Nitrogen to about 4 mg/L.

Systems designed to remove phosphorus and nitrogen, A^2O Systems, utilize anaerobic, anoxic and aerobic stages. Most biological wastewater treatment processes can reduce phosphorus by 10 to 20 percent. Phosphorus is reduced in wastewater treatment because it is an essential nutrient for biological cell growth.

Placing the anaerobic stage first followed by anoxic and aerobic stages can enhance the amount of phosphorus removal. Placement of the anaerobic stage first and following it with an aerobic stage causes a type of bacteria to predominate, which takes up, more than the standard amount of phosphorus. These bacteria accomplish the needed phosphorus reduction. Nitrogen is removed in the anoxic-aerobic stages, as discussed in the previous paragraphs.

Typically A^2/O systems can remove phosphorus to levels below 3 mg/L and nitrogen to levels below 10 mg/L. Phosphorous removal, however, is typically not required for groundwater disposal unless the location for the groundwater discharge is in close proximity to a sensitive surface waterbody. The levels of treatment obtained by all three of the Anaerobic/Anoxic/Oxic systems discussed above are consistent with effluent limitations required for this study.

Many of the treatment technologies discussed in the previous paragraphs were not able to meet proposed nutrient effluent discharge requirements. An A/O system, with one of the above technologies as the aerobic component, will result in proposed effluent requirements being met. The following treatment technologies could serve as a component of the A/O system: extended aeration, pure oxygen activated sludge, and oxidation ditch. Sequencing batch reactors were not considered because they have the ability to meet nitrogen requirements without the addition of an A/O system.

Of the treatment technologies available, extended aeration offers the most benefits when used in conjunction with an A/O process. Pure oxygen activated sludge tends to be more expensive than extended aeration due to the cost of purchasing and generating the oxygen. The oxidation ditch tends to take up more space, would be more costly to build and would be faced with community acceptance issues as well.

Fixed Film Biological Processes

Fixed Film Biological Processes are like suspended growth biological processes in that they rely on microorganisms to accomplish reduction of organic pollutants. The difference between the two is the medium in which the microorganisms thrive. With suspended growth systems, the biological population is kept in suspension in a tank. With fixed film processes, microorganisms grow on a surface and wastewater is applied to the surface or the surface is applied to the wastewater. These treatment alternatives need to be preceded by primary clarifiers in order to meet the required BOD_5 and TSS effluent requirements. Depending on the fixed film biological process implemented, secondary treatment levels or better can be achieved. A total of three fixed film biological processes will be considered.

Trickling Filters

With Trickling Filters, organic pollutant removal is accomplished by passing wastewater over a collection of loosely packed media. Microorganisms grow on the surface of the media and feed on the organic matter in the wastewater. With time, the biological growth falls off the media and flows out of the trickling filter tank with the treated wastewater. Air, needed by the microorganisms to degrade organics, is entrained in the wastewater as it falls though the media. The typical process also employs a secondary clarifier to separate biological matter from treated wastewater. Trickling filters can accomplish secondary levels of treatment and can generally reduce BOD_5 and TSS to 30 mg/L. Trickling Filters are not capable of consistently achieving BOD_5 and TSS levels of 10 mg/L in colder climates. In warmer climates a two stage Trickling Filter can generally reduce BOD_5 and TSS to 10 mg/L, NO_3 to 19 mg/L and NH_3 to 1 mg/L. Nitrification (i.e., oxidation to convert ammonia into nitrate) is also possible, but total nitrogen removal is not feasible using trickling filters.

Trickling Filters can't remove nitrogen to required levels. The nature of the Trickling Filter is such that it must be covered to perform properly. As such, it will not be able to operate in Nantucket's climate without this protection.

Another option is to enclose the Trickling Filter in a building, however this is not recommended due to the ventilation requirements of the filters. Covering of the treatment process is assumed to be necessary for community acceptance, however it will add to the construction cost of the facility.

Rotating Biological Contactors

Similar to Trickling Filters, Rotating Biological Contactors (RBC's) involve growing bacteria on media. However, RBC's utilize large moving disks that rotate through the wastewater rather than stationary media, which has wastewater, passed over it. The rotating disk causes the microorganisms to be exposed to cycles of air and wastewater (organics). The rotating action also causes shear forces to slough off the bacterial growths. A final clarifier captures the sloughed-off biological material. The principles involved are essentially the same for RBC's and Trickling Filters. The advantage of RBC's is that they tend to be more reliable and less susceptible to shock loading. Aerobic RBCs can generally reduce BOD_5 and TSS to 10 mg/L, NO_3 to 19 mg/L and NH_3 to 1 mg/L. A two stage RBC with both an anoxic and oxic stage combined with the addition of methanol can economically reduce BOD_5, TSS and Total Nitrogen to 10 mg/L. With the use of RBCs, sludge thickening is not required.

Wastewater treatment using rotating biological contactor technology is a compact, relatively simple and reliable process that can easily be designed to remove nitrogen. The nature of the RBC is such that it must be covered to perform properly. Covering of the treatment process is also necessary for community acceptance. Another option is to enclose the RBC in a building, however this is not recommended due to access issues for operation and maintenance and the high cost to provide proper lighting and ventilation.

A**ctivated Biofilters**

An Activated Biofilter (ABF) is a dual biological process that employs both suspended growth and fixed film processes. In its typical arrangement, a fixed film process (such as a trickling filter) is placed in series with a suspended growth process (such as conventional activated sludge). The media used in the ABF process is commonly redwood boards because the return activated sludge is mixed with the influent flow upstream of the trickling filter. The two systems are usually combined in the Activated Biofilter arrangement in order to take advantage of the strengths of each process. They are resistance to shock loads and ease of maintenance for trickling filters and the flexibility and high-quality effluents of conventional activated sludge. This type of system is capable of nitrification, however removal of total nitrogen is not feasible with this process. The ABF is capable of reducing BOD_5 and TSS to 10 mg/L, NO_3 to 19 mg/L and NH_3 to 1 mg/L.

The Activated Biofilter is a treatment technology, which utilizes both, suspended growth and fixed film systems. These types of systems can not remove nitrogen to required levels. While also taking advantage of the best features of suspended growth and fixed film systems, Activated Biofilters also suffer similar criteria problems for each type of system as described in the previous sections.

Physical/Chemical Processes

Physical/Chemical Processes are those processes that involve removal of pollutants solely through the use of gravity settling and chemical addition and/or the addition of particles that attract pollutants to surfaces. Biological activity is not intended to be the principal pollutant-reduction mechanism in physical/chemical treatment. The following three physical/ chemical alternatives will be discussed:

Chemical Coagulation

In general, particles in wastewater do not have an affinity for one another and do not have a great tendency to agglomerate. Chemical coagulation involves the addition of chemicals to increase particle affinity and therefore the tendency for agglomeration. The overall process is usually accomplished in three steps: coagulation, flocculation and sedimentation. In the coagulation step, chemicals such as aluminum sulfate or iron salts are added to the wastewater and mixed rapidly to destabilize solids. In the next step, flocculation, the destabilized solids are mixed slowly to encourage agglomeration. In the last step, the destabilized, agglomerated particles are settled out in a sedimentation tank. Chemical coagulation can remove BOD_5, TSS, insoluble organic nitrogen and phosphorus, but is not effective in removing total nitrogen to the required levels.

Chemical coagulation is not well suited to surges in flow and load, as chemical dosages would constantly require adjustment to match influent conditions. Complicated process control, large tankage and flow equalization would be required.

Chemical coagulation can remove BOD_5, TSS and phosphorus, but is not effective in removing total nitrogen to the required levels. As such, treated effluent will not be suitable for groundwater discharge that would raise regulatory and legal issues. Other issues include the cost of the chemicals, and the large quantity of chemical sludges produced.

Granular Activated Carbon

Treatment using granular activated carbon relies on the principle of adsorption. Adsorption is a physical/chemical process by which materials accumulate on surfaces. Since adsorption is a surface-active phenomenon, the larger the surface the greater the tendency for adsorption to occur. Activated carbon is a popular substance for adsorption because of its large surface area. Granular activated carbon is typically not used in wastewater treatment because of the size and amount of solids in the waste stream. It would not be effective in removing nitrogen and phosphorus. It is better suited for removal of small particles and residual organics. The Granular Activated Carbon process would not be very effective without significant process addition and modification. The drawbacks to the use of this process as a treatment technology are identical to chemical coagulation. In addition there are additional operation and maintenance cost issues due to the need to regenerate the carbon.

Zimpro PACT

Zimpro PACT is a patented process in which powdered activated carbon (PAC) is added to the aeration tank of the conventional activated sludge process. DuPont developed the process in the early 1970's, but Zimpro/Passavant currently holds the patent. Once in the aeration tank, the bacteria and the PAC work together to reduce organic material. The bacteria degrade most of the organics and the PAC handles the remaining portion. In the conventional arrangement, sludge and PAC are settled out in a clarifier and then returned to the aeration tank or wasted. When the PAC becomes spent, it must be replaced or regenerated. Wastewater treatment facilities employing the PACT process can achieve effluent BOD_5 and TSS of 10 mg/L, but have not achieved effluent total nitrogen and phosphorous concentrations to low levels that may be required for a facility in Nantucket.

As with Granular Activated Carbon, Zimpro PACT is usually used for the removal of small particles and residual organic matter. Zimpro PACT would not be very effective without significant process addition and modification and the drawbacks to its use as a treatment technology are identical to chemical coagulation. Zimpro PACT is commonly used for industrial discharge; however, it is generally more cost effective for industries to use some form of pretreatment rather than the PACT process. The PACT process also creates more sludge and operating costs due to the addition of PAC than the previously mentioned technologies.

Natural Systems Processes

Natural Systems Processes involve utilization of naturally occurring plants and animals for wastewater treatment. These types of systems consist of some tankage, but mostly consist of large basins, ponds and wetlands. A total of three Natural Systems Processes will be discussed.

Aquaculture

The Aquaculture process for treating wastewater generally consists of a series of greenhouses and wetlands. Influent first passes through the headworks, where grit and large objects are removed. From there, wastewater flows to a greenhouse, which houses a series of solar tanks and solar ponds. Here, aquatic and non-aquatic plants, bacteria and aquatic animals provide treatment. Next, wastewater flows to clarifiers, sand filters and constructed wetlands. The clarifiers separate biological solids from the water and the sand filters remove residual solids prior to reaching the constructed wetland. The purpose of the constructed wetland is to accomplish the last phase of nitrogen removal. Aquaculture treatment systems are capable of reducing BOD_5 and TSS to secondary treatment standards (30 mg/L). Nitrogen and phosphorus removals are also reported to be feasible.

Constructed Treatment Wetlands

Constructed treatment wetlands are essentially man-made systems designed to provide biological and chemical conditions that mimic natural wetlands systems. However, unlike a traditional treatment facilities, these treatment wetland systems offer many additional advantages, including longer service life, low O&M costs, and a variety of aesthetic values. Treatment wetlands are comprised of rooted vascular plants within shallow flooded or saturated soils that provide conditions effective for wastewater treatment. The two types of treatment systems include surface-flow wetland systems (SF) and subsurface-flow wetland systems (SSF). The SF wetland systems consist of an excavated lined basin containing a shallow substrate that supports emergent wetland vegetation. Treatment in the SF wetland occurs primarily in the rhizomes of the plant material. The SSF wetland systems use a bed of soil or gravel media for the growth of plants. Wastewater in the SSF wetland systems flows by gravity horizontally through the media were most of the treatment occurs from interaction with aquatic microorganisms. Typical plants used in these treatment wetland systems include common reed (Phragmites communis), cattail (Typha spp.) and bulrushes (Scirpus spp.).

Wetlands have been incorporated into wastewater treatment systems for more than 25 years and have become a popular waste treatment alternative for communities in both the U.S. and Europe. Recent estimates have identified approximately 1,000 constructed wetlands are currently operating, ranging from treatment for single-family homes to large-scale municipal systems. Cities and towns such as Marion, MA, Minoa, NY, Iselin, PA; Arcata, CA; Orlando, FL; PA; Monterey, VA and Columbia, MO have combined conventional treatment technologies with treatment wetland systems to achieve discharge requirements. The EPA issued a design manual (1988) formally recognizing constructed wetland technology, and site-specific guidelines for their design have been developed in many states. This Design Manual, “Constructed Wetlands and

Aquatic Plant Systems for Municipal Wastewater Treatment Disposal" is currently being updated by EPA to address the advances in technology and understanding of these systems.

The effectiveness of these treatment wetland systems is based largely on the level of pre-treatment, conservative estimates of constituent and hydraulic loading rates, monitoring and operational strategies. Design parameters for the size of these systems vary according to the treatment goals, estimated wastewater volumes, effluent characteristics and hydraulic loading. General sizing for approximately 1 MGD with a basin depth of 3 feet and a detention time of 6 days would require approximately 6 acres.

Relatively elevated concentrations of trace metals can be found naturally occurring in the streams and waterbodies in Nantucket. These metal concentrations (i.e.: copper and lead) are found in groundwater within the aquifer. Treatment wetlands can be effective at reducing metal concentrations. Reduction of metals within the treatment wetlands can be accomplished through immobilization in the surface soils or assimilation by plants and animals. The reduction of metals is largely correlated to the inflow concentrations and detention times. Specific performance data on the removal of trace metals from treatment wetlands is limited.

Treatment wetlands systems are generally designed for the reduction of levels of conventional pollutants including, nitrates, fecal coliform, Biological Oxygen Demand (BOD) and Total Suspended Solids (TSS). The treatment wetland systems should be viewed as a component in optimizing the overall wastewater treatment process rather than a means to reduce trace metals. The use of these wetland systems for this purpose is considered speculative. The applicability of using treatment wetlands for wastewater disposal in Nantucket is viewed as a final component in the treatment process prior to a direct discharge to surface water or groundwater infiltration system. The option of discharging treated wastewater to surface waters/wetlands is not feasible in Nantucket due to the lack of dilution potential offered by the low flow streams. However, the implementation of a treatment wetland system could function as a buffer by providing a "polishing" component in the treatment process.

In summary, the treatment wetland system could be used as part of a surface water discharge in functioning to minimize the potential impacts to natural wetland systems. Properly constructed treatment wetlands could control the quality and quantity of the discharge, reduce channelized flow and assimilate nutrient levels. The implementation of treatment wetland system as a component of the wastewater plan would require site-specific characterization of the receiving waters and development of discharge parameters.

Solar Aquatics™

The Solar Aquatics™ treatment process, a proprietary design, is characterized as a natural system by its developer. It utilizes elements of natural wetland systems, such as plants, subsurface wetland media and sand filtration with more conventional treatment elements such as diffused aeration and settling tanks. The Solar Aquatics™ process is housed in a greenhouse structure, which provides light for photosynthesis of its plant life, the ability to grow plants year-round, as well as provide an attractive appearance. Several Solar Aquatics™ facilities are currently operating in the region. Solar Aquatic™ systems are capable of reducing BOD_5 and TSS to secondary treatment standards (30 mg/L). Designs are available which are reported to reduce BOD_5, TSS and Total Nitrogen to 10 mg/L. Phosphorus removals are also reported to be feasible.

6. Existing Wastewater Infrastructure

The Town is currently undertaking an evaluation and mapping program for the entire collection system. The evaluation and program consists of the following: (1) visual inspection to identify materials of construction, system configuration, depth of structure, and identification of defects; (2) topographic survey to locate the existing manhole structures and obtain rim elevation; (3) creation of a system map compatible with the Town's existing GIS system; and (4) provide the Town with priorities for system repairs and/or modifications. Nantucket's existing wastewater Infrastructure is divided into two service areas.

The first service area collects, transmits, treats and disposes of wastewater generated from the Town area of the Island. The service area consists of approximately 34 miles of sewer, 6 pumping stations, and a 2.24-mgd advanced primary wastewater treatment facility (WWTF). The Surfside WWTF is located on South Shore Road in the Southwest region of the Island. The facility is currently permitted to discharge 1.80 mgd of advanced primary treated effluent during the summer months into 10 rapid infiltration basins. The service area encompasses approximately 2,000 acres of land out of a total 30,580 acres on the Island. The Surfside WWTF serve approximately 4,000 residential and commercial customers.

The second service area collects, transmits, and disposes of wastewater generated from the Siasconset area of the Island. The service area consists of approximately 5 miles of sewer, and a 0.12-mgd discharges raw wastewater into six infiltration basins. The Siasconset WWTF is located on Low Beach Road in the Southeast region of the Island. Over the last decade, the Town has been in the process of planning, design and permitting an advanced wastewater treatment facility. The Siasconset WWTF is design for advanced treatment of the wastewater with an average daily flow of 0.22-mgd and discharge limits of 10 mg/L BOD_5, 10 mg/L TSS and 5 mg/L Total N. Currently the proposed facility is under construction and consists of the following components: (1) Influent Flow Measurement; (2) Primary Clarifiers; (3) Sequencing Batch Reactors; (4) Post Equalization; (6) Effluent Filtration; (6) Ultraviolet Disinfection; (7) Effluent Flow Measurement; (8) Sludge Holding Tanks; (9) Scum Holding Tank; (10) Odor Control System; and (11) Rehabilitation of the Existing Rapid Infiltration Basins. The service area encompasses approximately 1,012 acres of land out of a total 30,580 acres on the Island. The Siasconset WWTF will serve approximately 700 residential and commercial customers.

Collection System Tributary to the Surfside WWTF

The sewer collection system tributary to the Surfside WWTF consists of approximately 34 miles of sewer. The size of sewer pipes range from 4 to 30 inch in diameter. The average pipe diameter in the system is 6 and 8 inches. The majority of the sewer system flows by gravity and the most common pipe material is VC with oakum-mortar joints. The manholes are generally round brick or concrete block construction with cast-iron frames and covers. Most manholes are without steps and range between 2 to 17 feet in depth, with an average depth between 6 and 8 feet.

The gravity sewers discharge to a pumping station on Sea Street where the sewage is pumped through either of two force mains to the Surfside filter beds; a 20-inch ductile force main installed in 1981, or a 20-inch cast-iron force main relined with 16-inch polyethylene liner pipe installed in 1984. The total distance from the pumping station to the ten slow sand filter beds on the south shore of the Island is about 17,800 feet. The pumping station, the original force main, and original seven filter beds were built in 1929. Beginning at the pumping station, 5,300 feet of force main was repaired in 1959 and during the period repairs were in progress, an emergency force main bypass discharging to the ocean at Brant Point was constructed and placed in service to permit the repairs. The emergency bypass has been taken out of service.

Collection System Tributary to the Siasconset WWTF

The sewer collection system tributary to the Siasconset WWTF consists of approximately 5 miles of sewer. The size of sewer pipes range from 4 to 12 inch in diameter. The average pipe diameter in the system is 6 and 8 inches. The sewer system flows by gravity to the existing rapid infiltration basins and the most common pipe material is VC with oakum-mortar joints. The manholes are generally round brick or concrete block construction with cast-iron frames and covers. Most manholes are without steps and range between 2 to 15 feet in depth, with an average depth between 6 and 8 feet.

Wastewater Pumping Stations

There are six pump stations located throughout the Town that convey the Town's wastewater to Surfside WWTF. The stations types consist of two submersible pump stations, two suction lift pump stations, one air injection pump station and one custom built station. Refer to Table 2-7 for a summary of the pumping stations.

TABLE 2-7
TOWN OF NANTUCKET
CWMP/FEIR
WASTEWATER PUMPING STATIONS SURVEY SUMMARY

ID	Pump Station Name	Type of Station	Year		Pumping System				Station Alarms (Y / N)	Emergency Generator (Y / N)	Comments
			Built	Upgrade	Design Capacity	No.	Miscellaneous	HP			
1	Airport Pump Station	Submersible	1989	None	300 GPM 48' TDH 1750 RPM	2	ABS AF60-4 4 inch Discharge		Y (Phone)	N	• Pump Run Times: 7,698 hours and 6,412 hours • Float controlled • Feeds Old South Road Pump Station • No flow measuring device • Control Panel needs to be replaced due to corrosion. • One pump overhauled
2	Cato Lane Pump Station	Submersible	1964	2003	85 GPM 13' TDH 1750 RPM	2	ITT/Flygt CP3085-440 4 inch Discharge	3	Y	N	• Ejector Station Replaced in 2003 • Feeds Surfside Pump Station • No Flow measuring device
3	Old South Road (South Valley) Pump Station	Suction Lift	1989	None	980 GPM 81' TDH 1765 RPM	3	Gorman Rupp T6A3-B 12 3/8th inch impeller	40	N	Y	• DMT Corp. Generator: 100kW, 125kVa, 150 amps, 277/430 V, 3 ph, 60 Hz • Generator run time = 65 hours • Pump Run Times: 250 hours, 215 hours, and 223 hours • Structure condition good • Control Panel parts have been discontinued. • Town Maintained from 1989 to 1991 and 2001 to present. • Air bubbler controlled • Flow measurement device by Polysonics • Flow to station is much lower than design capacity.

TABLE 2-7 (cont)
TOWN OF NANTUCKET
CWMP/FEIR
WASTEWATER PUMPING STATIONS SURVEY SUMMARY

ID	Pump Station Name	Type of Station	Year Built	Year Upgrade	Pumping System Design Capacity	Pumping System No.	Pumping System Miscellaneous	Pumping System HP	Station Alarms (Y / N)	Emergency Generator (Y / N)	Comments
4	Pine Valley Pump Station	Submersible	1989	None	458 GPM 47' TDH 1150 GPM	2	ABS AFP/N-15		Y (Phone)	N	• Floats used for controls • 8" gravity in, 4" FM out • No flow data • Feeds Surfside Pump Station
5	Sea Street Pump Station	Custom Building	1930	1994	1800 GPM 86' TDH VFD	3	Worthington 6MF17FR6 Westinghouse Motor 460V, 3ph, 60Hz, 1170 RPM	75	Y	Y	• Screen Motor: Underwriters Laboratories, FAB239175, 3 hp, 3ph, 1725 rpm, 230/408V • Grinder Motor = Underwriters Laboratories, SZ541361, 3 hp, 233V, 1725 rpm, 60 cycles, 3ph • Kohler Generator: 3ph, 60Hz, 277/480V, 230 kW, 288kVa, 346 Amps, 185 hrs.
					1900 GPM 78' TDH VFD		Clow Yeomans 5k6404AS308 GE Motor 460V, 3ph, 60Hz, 1190 RPM	60			
6	Surfside Pump Station	Suction Lift	1987	None	980 GPM 68' TDH 1400 RPM	2	Gorman Rupp T5A3-B	40	Y	Y	• Pump Run Times – 5,721 hours and 4,672 hours • Flow measurement device by Polysonics • Allen Bradley Control Panels, parts difficult to obtain • Generator only capable of running 1 pump. • Superior Generator: 75 kW, 93.75 kVa, 112 amps, 3ph, 60Hz, 277/480V

Pine Valley Pump Station

The Pine Valley Pump Station was constructed in 1989 and utilizes submersible pumps as the mean to convey wastewater. The station is privately owned and maintained. The station does not have a flow measurement device, on-site emergency generator or capability of alarm transmission to the Surfside WWTF. Wastewater flows from Pine Valley Pump Station are pumped into the collection system that is tributary to the Surfside Road Pump Station.

Airport Pump Station

The Airport Pump Station was constructed in 1989 and utilizes submersible pumps as the mean to convey wastewater. The Town has only maintained the Airport Pump Station since early 2000 when it took control of the station from the Nantucket Inn. The Airport Pump Station's control panels are badly corroded and are in need of replacement. The station does not have a flow measurement device, on-site emergency generator or capability of alarm transmission to the Surfside WWTF. Wastewater flows from Airport Pump Station are pumped into the collection system that is tributary to the Old South Road Pump Station.

Cato Lane Pump Station

At the beginning of this project, the Cato Lane Pump Station was the only air injection station and was in poor condition as its structure was in need of an upgrade. This ejector station lacked suitable access for proper operation and maintenance, did not have a flow measurement device, on-site emergency generator or capability of alarm transmission to the Surfside WWTF. During 2003, the Cato Lane Pump Station was completely replaced with a submersible pumping station as part of the Siasconset WWTF project. Wastewater flows from Cato Lane Pump Station are pumped into the collection system that is tributary to the Surfside Pump Station.

Old South Road Pump Station

Old South Road Pump Station (also known as South Valley Pump Station) utilizes suction lift pumps as the mean to convey wastewater. The Town maintained Old South Road Pump Station from 1989 to 1991. The South Valley Subdivision Community took over the maintenance of the pump station from

1991 to 2001. In February of 2001, the Town took back the responsibility to maintain the Old South Road Pump Station. Flow to this station is much lower than design capacity and therefore has created some operational problems. The station does not have an on-site emergency generator or capability of alarm transmission to the Surfside WWTF. Wastewater flows from Old South Road Pump Station are pumped directly to the Surfside WWTF.

Surfside Road Pump Station

Surfside Road Pump Station utilizes suction lift pumps as the mean to convey wastewater. The Surfside Road Pump Station is in need of a new generator since the existing generator is capable of only running one pump, which reduces the flexibility and redundancy of the station. Wastewater flows from Surfside Road Pump Station are pumped directly to the Surfside WWTF.

Sea Street Pump Station

Sea Street Pump Station is the largest pump station located in a custom building in the center of the downtown area. This is the oldest station dating back to around 1930. The station has gone through two major upgrades, the most recent in 1994. The Town is planning to replace the existing comminutor with a bar screen. Currently the station has experienced a problem with excessive grease in the collection system that accumulates in the station's wetwell. In addition, the Town has also experience problems with the variable frequency drives at Sea Street. Wastewater flows from Sea Street Pump Station are pumped directly to the Surfside WWTF utilizing either a 20-inch diameter force main or 16-inch diameter force main.

The Sea Street pumping station was built in the 1930s and consists of a one-story superstructure, 30 feet by 32-feet in plan partitioned into two sections comprising of an 11-foot by 32-foot wet well extending below grade along the rear of the building and a ground level control room with a below-grade dry well occupying the remaining space on the street side.

In the 1970s a headworks facility consisting of a comminutor and by-pass bar rack was constructed to replace the manually cleaned screen cages. In addition, an emergency generator was added to maintain operation of the station in the event of a power outage. This equipment was installed in a new building located directly behind the existing superstructure and was constructed adjacent to the existing wetwell.

In the early 1990s, the pump station was upgraded to include the installation of a channel grinding mechanism, chemical addition storage and feed equipment for the force main and wetwell, activated carbon odor control system, ozone generation and wetwell distribution equipment, separation of a large wetwell into two compartments to facilitate cleaning, replacement of 2 pumps and the additional of variable speed drives.

Portable Generator

For the three pump stations that do not have an on-site emergency generator, the Town utilizes a portable generator during normal power failures. The portable generator is currently stored at the Surfside WWTF. The portable generator is covered with rust and requires some minor repairs.

Infiltration/Inflow

An infiltration/inflow (I/I) study was initiated on the Island of Nantucket in March of 1988. A previous study had been conducted in 1973. The objective of the I/I investigation was to identify the portions of Nantucket's wastewater collection system that contribute excessive I/I to the local wastewater facility and to develop a list of cost effective recommendations for the elimination or reduction of these I/I sources.

The sewer system in the Town of Nantucket was divided into seven Mini-systems, M1, M2, M3, N1, N2, N3 and N4. Mini-system M1 was reported with excessive infiltration with approximately 157,000 gpd. While mini-systems M1, M2, M3, N1 and N2 were noted to incur 87 percent of the total inflow. In 1987 State Guidelines suggested that mini-systems that account for at least 80 percent of the total system inflow must be subjected to a Sewer Service Evaluation Survey (SSES).

The SSES was performed to identify the specific locations of I/I sources, to quantify the amount of I/I, to identify the method of rehabilitation to eliminate I/I, and to justify rehabilitating each defined I/I source. Included in the SSES was flow isolation, manhole inspections, private source inflow questionnaires, internal building inspections, smoke testing, and dyed-water testing. The SSES was completed in 1989 and submitted to and approved by the Massachusetts DEP in 1991. Final conclusions and recommendations from the report include:

- Total removable design peak inflow amounted to 1.978 mgd, of which approximately 1.68 mgd is attributable to private inflow sources;
- Approximately 160,000 gpd of infiltration was identified of which approximately 20,000 gpd was found to be cost effective to be removed;
- Rehabilitate sewer lines and manholes identified in the cost-effective analysis;
- Perform a testing and sealing program of identified leaking service connections;
- Remove illegal connections to sewer system;
- Develop a regular maintenance program including flushing the sewer lines to minimize the build up of debris and to maintain hydraulic capacity; and
- Correct collapsed pipes and broken inverts, and remove heavy root intrusion that contribute to heavy infiltration.

After the completion of the 1991 Town of Nantucket Infiltration/Inflow Analysis and Sewer System Evaluation Survey, the Town has taken a number of steps to remove I/I from its sewer system. Amongst the steps taken are the following:

- Removal of illegal connections;
- Removal of suspect catch basins;
- Purchased equipment to aid in locating and repairing broken lines and potential I/I sources;
- Developed an Operation and Maintenance program that includes two full time staff dedicated to the maintenance of the collection system;
- Manhole repairs and installation with an average of 10 manholes repaired per year and 6 manholes replaced installed per year; and
- Replacement of the Washington Street Area interceptor that was identified as a line that: (1) was a source of several surcharging events per year; (2) was a source of significant infiltration; (3) created a maintenance problem caused by a continual build-up of debris; and (4) had various structure defects.

7. Existing Wastewater Treatment Facilities

Background

Earth Tech provided wastewater master planning services, including facilities planning and EIR completion, for the Town of Nantucket. These services included the planning, design and construction of the Surfside Wastewater Treatment Facility and the Siasconset Wastewater Treatment Facility. The Surfside Wastewater Treatment Facility was completed in 1991. Severe storms caused significant erosion that postponed construction of the coastal Siasconset Wastewater Treatment Facility. Shortly thereafter, Earth Tech evaluated short-term measures to be utilized as interim solutions for the Siasconset wastewater disposal issue. The final result was only minor modifications being made to the existing infiltration basins in 1991. In July 2002, an updated Coastal Erosion Report was completed at the Surfside WWTF site. The Woods Hole Group completed this and the former coastal erosion report done in July 1999 under subcontract with Earth Tech. The reports summarize the fact that erosion is not an issue at this site. A copy of both these erosion reports are included in Appendix C.

Surfside Wastewater Treatment Facility

The Surfside Wastewater Treatment Facility treats flow generated from the Center of Nantucket and has a design capacity of 2.24 MGD. The Surfside Wastewater Treatment Facility consists of a septage receiving tank, aerated grit chamber, three primary clarifiers that utilize ferric chloride and polymer for enhanced treatment, ten rapid infiltration basins, three aerated sludge holding tanks, one aerated septage equalization tank, and process support systems. Sludge and septage are dewatered with belt filter presses and can be mixed with wood chips in a portable mixer using aerated static pile method to produce a product that meets DEP Standards for a Type I sludge or composted with municipal solid waste. Currently, the Town transports the dewatered solids to the Town landfill for co-composting in a privately operated facility. The facility has been in operation since 1991 and underwent improvements in 1992 for odor control and improved primary treatment.

A key element of the facility's design is the odor control system, which treats odorous air from the sludge dewatering area, grit dewatering area, sludge storage, septage equalization, and the compost operation. The 4-stage odor control system utilizes a water cooling chamber for the compost pile off gases, an acid wash chamber for ammonia odors, a sodium hypochlorite and sodium hydroxide scrubber for hydrogen sulfide, and an activated carbon chamber for volatile organics. The process also includes chemical addition to the sludge and septage holding tanks and to the sludge suction of the belt filter press feed pumps as a back up to the air scrubbing system.

In addition, the Surfside Wastewater Treatment Facility is designed to receive an average of 11,200 gallons per day of septage. The septage can be processed using several methods: (1) Pumping to the Headworks; (2) Pumping to the Cyclone Grit Classifier; or (3) Pumping to the Aerated Sludge Holding Tanks for Belt Press Dewatering.

The Nantucket Surfside WWTF provides primary settling for biochemical oxygen demand (BOD_5) removal and total suspended solids (TSS) removal. The Town's wastewater flows through a 12-inch Parshall flume where it is screened before continuing through an aerated grit chamber, primary clarifiers with the final effluent discharged into one of 10 rapid infiltration basins. Chemically enhanced primary treatment occurs during the summer months by the addition of chemicals are various injection points. Wastewater solids are stored in three aerated sludge holding tanks prior to dewatering utilizing belt filter presses. Although the facility has the capability to stabilize the dewatered wastewater sludge, using aerated static pile composting, the facility discontinued composting operations in 1997 and the dewatered sludge is transported to an on-island municipal solid waste composting facility that is privately operated. The following is a summary of the unit process:

- One Aerated Grit Chamber with a dimension of 12 feet by 14 feet with sidewater depth of 10 feet.
- One Septage Holding Tank with dimensions of 16.25 feet by 18 feet with a total storage of approximately 19,700 gallons.
- Three Primary Clarifiers with dimensions of 81.5 feet by 18 feet with a side water depth of 7 feet.
- Three Aerated Sludge Holding Tanks with varying dimensions of 16.25 feet by 18 feet for Tank No. 1 and Tank No. 2, and 13 feet by 25 feet for Tank No. 3.
- Two 1.0 meter Belt Filter Presses.
- Ten Rapid Infiltration Basins each 1.02 acres with a maximum loading depth of 2.5 feet.
- Multi-stage odor control system consisting of cooling chamber, acid wash chamber, mist chambers followed by activated carbon chambers.
- Chemical storage and feed systems for chemically enhanced primary treatment.

The Nantucket Surfside Wastewater Treatment Facility (WWTF) was designed in 1987 for expected conditions up to the summer of 2007 and is currently permitted to discharge 1.80 mgd. Although the Surfside WWTF is designed for 2.24-mgd, it currently has a Class III Groundwater Discharge Permit issued by the Massachusetts DEP for only 1.80 mgd. Table 2-8 provides the limits imposed by the DEP Class III Groundwater Discharge Permit issued March 4, 1992. A complete copy of the permit is included in

Appendix D. Over the last few summers, the facility has approached its permitted flow limit. The DEP has refused the Town's application to increase its discharge permit limits to its capacity of 2.24 mgd.

Since the filing of the Phase II Report in September 2003, the Town entered into an Administrative Consent Order (ACO), ACOP-BO-03-1G002, with the Massachusetts Department of Environmental Protection on October 22, 2003 in the matter of the Surfside Wastewater Treatment Facility. The ACO encompasses alleged permit limit violations, establishment of a sewer bank, infiltration/inflow analysis and system rehabilitation, deadlines for the upgrading of the WWTF to meet Class I Discharge standards and various milestones to be accomplished with regards to the permitting, operating and maintaining of the WWTF. A Preliminary Design Report (PDR) is been completed, which will enable the Town to meet the ACO deadline for a new Surfside WWTF. Refer to Appendix A for the complete ACO. The schedule of recommendations from this CWMP/FEIR are being revised in order to coordinate and comply with the provisions of the ACO.

TABLE 2-8
TOWN OF NANTUCKET
CWMP/FEIR
MASSACHUSETTS GROUNDWATER
DISCHARGE PERMIT No. 1-200 LIMITS

Effluent		Discharge Limitation	
Characteristics	Units	Average Daily	Maximum Daily
Flow	mgd	1.80	5.80
BOD_5	mg/L	215	230
TSS	mg/L	225	230
Oil & Grease	mg/L	15.0	
pH	---	6.5 – 8.5	

The detailed design criteria for the existing Surfside WWTF is included in Table 2-9.

Peak flow on the Island is in the summer months between June and September and has averaged 1.63 mgd as shown on Table 2-10 and Figure 2-11. The off-peak season on the island records lower flows during the months of October through May, with an average of 1.05 mgd. The quantity of wastewater into the wastewater system is influenced heavily by the summer months, of which includes tourist season and an increase in the residential population.

TABLE 2-9
TOWN OF NANTUCKET
CWMP/FEIR
SURFSIDE WWTF DESIGN DATA

Criteria	Initial Year (1987)	Future Year (2007)
Design Loading Data		
Population	12,225	20,100
Flow (mgd)		
Average Daily	1.6	2.24
Domestic	1.5946	2.2288
Septage	0.0054	0.0112
Peak Daily	4.8	6.68
Biochemical Oxygen Demand (lbs/day)	3,729	5,871
Domestic	3,387	5,264
Septage at 15,000 mg/L	293	607
Suspended Solids (lbs/day)	3,729	6,426
Domestic	3,056	5,025
Septage at 15,000 mg/L	673	1,401
Process Design Data		
Aerated Grit Chamber		
Number	1	
Dimension, Each (feet)	12 x 14	
Side Water Depth (feet)	10	
Grit Screw Horsepower, Each	¾	
Air Requirements, Each		
Flow (cfm)	50 to 80	
Pressure (psi)	9	
Grit Washer		
Number		
12-inch Cyclone	1	
10-inch Classifier	1	
Horsepower	½	
Aerated Septage Holding Tank		
Number	1	
Size, Each (feet)	16.25 x 18	
Mixing Type	Diffused Air	

TABLE 2-9 (cont)
TOWN OF NANTUCKET
CWMP/FEIR
SURFSIDE WWTF DESIGN DATA

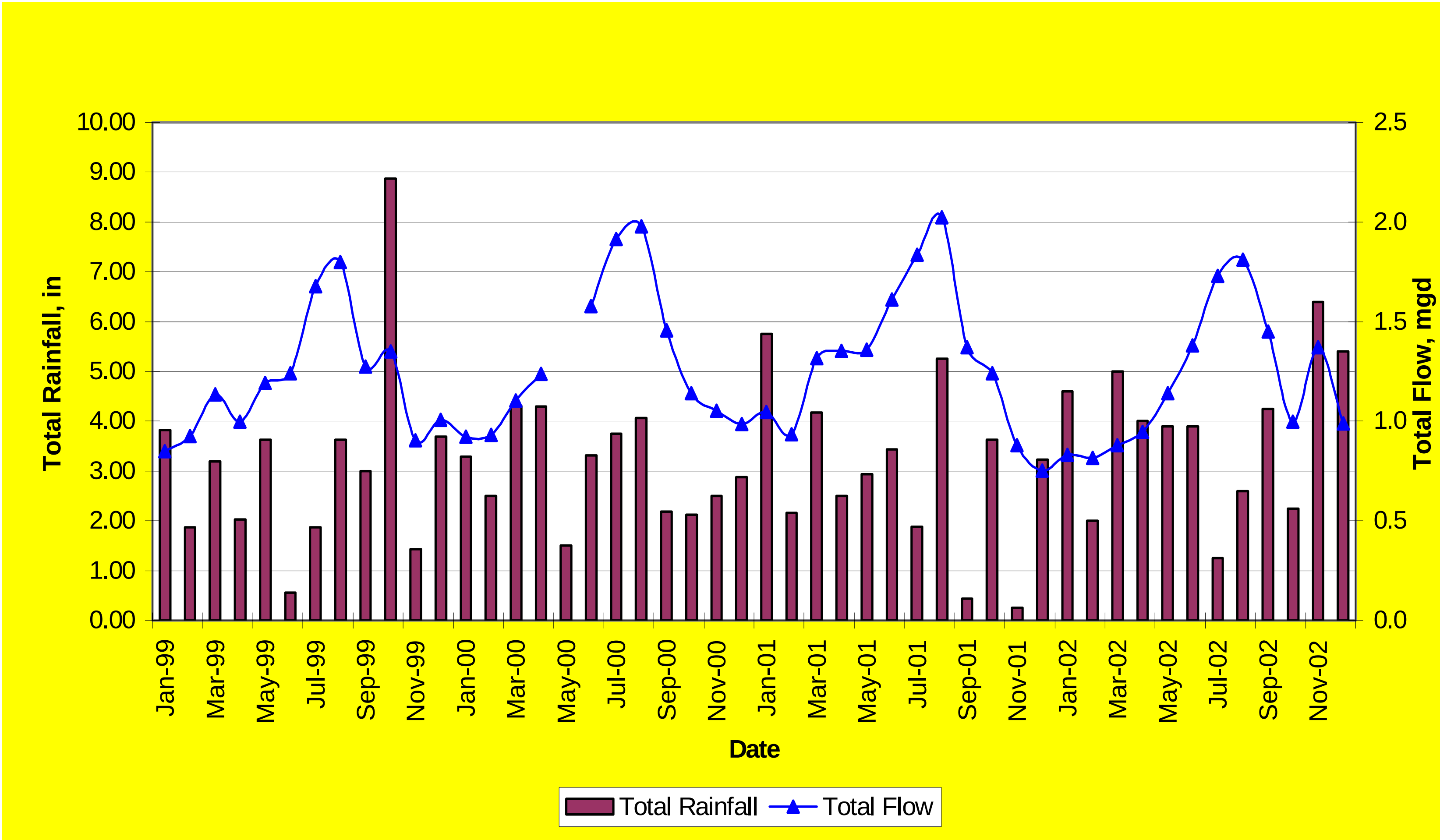
Criteria	Initial Year (1987)	Future Year (2007)
Air Requirements		
SCFM Per 1,000 CF	30	
Per Diffuser (scfm)	12	
Total Storage, Each (gallons)	19,690	
Primary Clarifiers		
Number	3	
Size, Each (feet)	81.5 x 18	
Side Water Depth (feet)	7	
Effective Surface Area, Each (square feet)	1,467	
Volume, Each (gallons)	76,812	
Overflow Rate (gpd/sq. ft.)		
Average Daily Flow	364	509
Peak Daily Flow	2,576	1,518
Loading Rate (gpd/lf of weir)	16,667	23,336
BOD Removal (%)	60	
Effluent SS (lbs/day)	1,492	2,570
Rapid Infiltration Basins		
Number Provided	10	
Average Loading Rate (gpd/sq. ft.)	4	
Loading Depth (ft)	2.5	
Basin Area (acres)	1.02	
Aerated Sludge Holding Tanks		
Number	3	
Size, Ea. (ft)		
Tanks 1 and 2	16.25 x 18	
Tank 3	13 x 25	
Depth, Ea. (ft)	9	
Volume Ea. (cu. ft.)		
Tanks 1 and 2	5,265	
Tank 3	2,981	
Total	8,246	
Mixing Type	Diffused Air	
Air Requirements		
SCFM per 1,000 CF	20	
Per Diffuser (scfm)	12	
Total Storage at 4 percent solids (gal)	61,680	
Total Storage at 4 percent solids (days)	9.2	5.34
Belt Filter Presses		
Number	2	
Size, Ea. (meter)	1	
Sludge Feed (lbs. D.S./wk)	15,662	26,990
Unit Capacity		
Dry Solids (lbs/hr)	1,000	
Liquid Feed (gpm at 4 percent D.S.)	50	
Washwater Requirements		
Flow (gpm)	65	
Pressure (psi)	85	
Unit Horsepower	7.5	
Operations (hrs/wk/unit)	11.17	17.83
Sludge Cake, Min (% D.S.)	25	
Polymer Required (lbs./ton D.S.)	5 to 10	

TABLE 2-10
TOWN OF NANTUCKET
CWMP/FEIR
SURFSIDE WWTF WASTEWATER
FLOWS (1999 through 2002)

Month	Average Flows (mgd)			
	1999	2000	2001	2002
January	0.85	0.92	1.05	0.83
February	0.93	0.93	0.93	0.82
March	1.14	1.10	1.31	0.88
April	1.00	1.24	1.35	0.95
May	1.19	N/A	1.36	1.14
June	1.24	1.58	1.61	1.38
July	1.68	1.91	1.83	1.73
August	1.80	1.98	2.02	1.81
September	1.27	1.45	1.37	1.45
October	1.35	1.14	1.24	1.00
November	0.90	1.05	0.88	1.37
December	1.00	0.99	0.75	0.99
Annual Average	**1.20**	**1.30**	**1.31**	**1.20**
Peak Season Average	**1.50**	**1.73**	**1.71**	**1.59**
Off-Peak Season Average	**1.05**	**1.05**	**1.11**	**1.00**

Although the Town continues to experience a high growth rate, the Town's efforts to reduce infiltration/inflow is reflected in the fact that the average for the last four years is only 1.25 mgd, considerable below the permit limit annual average of 1.80 mgd. The average daily discharge flow in 1999 was 1.20 mgd with a maximum flow of 1.80 mgd. The flow increased in 2000 with an average of 1.30 mgd with a maximum of 1.98 mgd. The flow in 2001 increased yet again to an average of 1.31 mgd with a maximum of 2.02. The average flow in 2002 dropped to 1.20 mgd with a maximum of 1.81 mgd.

FIGURE 2-11
TOWN OF NANTUCKET
CWMP/FEIR
SURFSIDE WWTF FLOWS AND PRECIPITATION



Refer to Table 2-11, Table 2-12, Table 2-13 and Table 2-14 for design loading data and process design data for the calendar years 1999, 2000, 2001 and 2002, respectively. The Nantucket Surfside Wastewater Treatment Facility is permitted to discharge an effluent BOD_5 of 215 mg/L. Over the last four years the facility's maximum effluent BOD_5 was 119 mg/L or approximately 55 percent of the permitted limit. The average effluent BOD_5 in 1999 was 89 mg/L, the average effluent BOD_5 in 2000 was 95 mg/L, and the average effluent BOD_5 in 2001 was 93 mg/L, and the average effluent BOD_5 in 2002 was 101 mg/L.

The Nantucket Surfside Wastewater Treatment Facility is permitted to discharge an effluent TSS of 225 mg/L. Over the last four years the facility's maximum effluent TSS was 34 mg/L or only 15 percent of the permitted limit. The average TSS discharge in 1999 was 34 mg/L, the average TSS effluent discharge in 2000 was 34 mg/L, the average TSS effluent discharge in 2001 was 35 mg/L, and the average TSS effluent discharge in 2002 was 40 mg/L.

TABLE 2-11
TOWN OF NANTUCKET
CWMP/FEIR
SURFSIDE WWTF PERFORMANCE - 1999

			Influent Quality			Effluent Quality					Sludge			
Month	Avg. Flow (mgd)	Oil & Grease	BOD (mg/L)	TSS (mg/L)	Total Solids (mg/L)	pH	Temp. (C)	BOD (mg/L)	TSS (mg/L)	Total Solids (mg/L)	Gals. (x 1000 gal)	Lbs (x 1000 lbs)	Feed Solids (%)	Cake Solids (%)
January	.85	15.8	174	122	1950	7.00	9.6	99	41	899	25.9	14.6	2.0	29.7
February	.93	19.9	128	96	983	6.87	9.5	119	62	696	19.1	13.1	2.7	29.5
March	1.14	14.0	126	82	590	6.92	9.5	81	50	497	22.8	13.5	1.8	30.8
April	1.00	29.4	148	96	556	6.85	12.0	102	45	461	23.6	13.6	1.7	28.6
May	1.19	7.4	N/A	N/A	N/A	6.89	17.9	83	35	948	27.7	17.6	2.7	27.3
June	1.24	6.2	260	238	650	6.79	19.4	75	18	535	32.1	19.9	2.7	29.0
July	1.68	8.0	218	226	687	6.78	22.6	87	17	471	37.6	21.5	2.9	31.4
August	1.80	9.6	N/A	N/A	N/A	6.81	23.5	91	16	514	40.6	22.4	2.7	29.8
September	1.27	7.8	233	282	652	6.75	21.5	77	15	451	33.3	17.3	2.2	28.5
October	1.35	9.8	177	184	550	6.83	18.1	59	26	373	28.1	13.0	2.3	28.5
November	.90	41.5	141	119	390	6.69	15.1	97	45	419	16.9	8.3	2.3	29.3
December	1.00	18.1	118	100	450	6.79	11.7	98	41	491	13.8	9.3	2.9	29.0
Total[1]	**14.35**										**321.2**	**184.1**		
Average	1.20	15.6	172	154	746	6.83	15.8	89	34	563	26.8	15.3	2.4	29.3
Minimum	0.85	6.2	118	82	390	6.69	9.5	59	15	373	13.8	8.3	1.7	27.3
Maximum	1.80	41.5	260	282	1950	7.00	23.5	119	62	948	40.6	22.4	2.9	31.4

N/A- Not Available
[1]The average, minimum, maximum under total are based on the monthly values reported in this table.

TABLE 2-12
TOWN OF NANTUCKET
CWMP/FEIR
SURFSIDE WWTF PERFORMANCE - 2000

			Influent Quality			Effluent Quality					Sludge			
Month	Avg. Flow (mgd)	Oil & Grease	BOD (mg/L)	TSS (mg/L)	Total Solids (mg/L)	pH	Temp. (C)	BOD (mg/L)	TSS (mg/L)	Total Solids (mg/L)	Gals. (x 1000 gal)	Lbs (x 1000 lbs)	Feed Solids (%)	Cake Solids (%)
January	.92	19.6	128	106	1782	6.8	9.5	90	42	491	19.5	11.3	2.3	30.6
February	.93	20.7	127	163	917	6.9	8.1	103	43	488	13.0	5.2	2.4	26.5
March	1.10	17.3	104	107	1465	6.9	10.8	84	44	767	21.3	12.1	2.1	31.2
April	1.24	21.0	N/A	N/A	N/A	6.7	12.1	89	50	409	28.6	16.9	3.0	31.0
May	N/A	15.8	N/A	N/A	N/A	6.8	15.6	99	47	443	24.3	15.2	2.7	31.9
June	1.58	11.0	191	113	635	7.0	19.1	75	18	406	28.2	23.9	3.1	26.9
July	1.91	8.7	209	185	774	7.0	21.5	98	11	552	40.2	28.1	2.4	28.4
August	1.98	11.8	257	305	723	7.1	21.4	96	20	480	42.2	23.6	2.1	29.3
September	1.45	37.1	153	76	615	6.9	20.5	89	27	604	36.3	17.8	1.9	28.9
October	1.14	20.0	N/A	N/A	N/A	7.0	18.5	96	30	587	38.7	19.3	2.4	28.5
November	1.05	23.0	N/A	N/A	N/A	7.0	14.0	110	33	526	27.0	16.6	1.6	29.3
December	.99	23.6	N/A	N/A	N/A	7.0	10.3	113	38	841	22.2	15.7	2.8	29.0
Total[1]	**14.30**	**229.4**									**341.8**	**205.7**		
Average	1.30	19.1	167	151	987	7.0	16.4	95	34	549	28.5	17.1	2.4	29.3
Minimum	0.92	8.7	104	76	615	6.7	8.1	75	11	406	13.0	5.2	1.6	26.5
Maximum	1.98	37.1	257	305	1782	7.1	21.5	113	50	841	42.2	28.1	3.1	31.9

N/A- Not Available
[1]The average, minimum, maximum under total are based on the monthly values reported in this table.

TABLE 2-13
TOWN OF NANTUCKET
CWMP/FEIR
SURFSIDE WWTF PERFORMANCE - 2001

			Influent Quality			Effluent Quality					Sludge			
Month	Avg. Flow (mgd)	Oil & Grease	BOD (mg/L)	TSS (mg/L)	Total Solids (mg/L)	pH	Temp. (C)	BOD (mg/L)	TSS (mg/L)	Total Solids (mg/L)	Gals. (x 1000 gal)	Lbs (x 1000 lbs)	Feed Solids (%)	Cake Solids (%)
January	1.05	18.0	145	90	1116	7.06	8.6	104	44	1162	30.0	11.2	1.3	28.2
February	0.93	22.8	116	88	383	7.07	8.2	93	36	973	23.4	15.5	3.0	27.0
March	1.31	24.2	133	139	497	7.02	8.5	83	52	687	19.3	13.3	2.7	28.4
April	1.35	14.9	129	99	419	7.08	11.0	101	39	381	36.0	23.9	3.4	30.3
May	1.36	18.4	141	166	565	7.08	16.4	72	26	427	35.6	21.4	3.5	28.1
June	1.61	7.0	251	277	742	7.13	19.6	92	39	479	39.2	23.0	3.2	25.4
July	1.83	10.0	210	215	814	7.17	22.5	103	26	535	37.6	26.1	3.3	27.2
August	2.02	8.6	233	225	684	7.01	22.8	96	17	451	39.3	25.3	2.7	28.5
September	1.37	19.2	209	245	757	6.87	20.9	81	19	564	31.4	15.9	2.4	28.0
October	1.24	13.7	190	190	617	6.93	19.2	92	33	507	25.6	14.4	2.9	27.8
November	0.88	25.7	166	165	581	6.95	15.5	129	47	518	21.0	14.1	1.9	29.5
December	0.75	21.0	150	94	741	6.97	12.4	145	54	643	13.0	8.0	2.5	29.4
Total[1]	**15.70**										**351.4**	**212.1**		
Average	1.31	17.0	173	166	660	7.02	15.5	99	36	611	29.3	17.7	2.7	28.2
Minimum	0.75	7.0	116	88	383	6.87	8.2	72	17	381	19.3	26.1	1.3	25.4
Maximum	2.02	25.7	251	277	1116	7.17	22.8	145	54	1162	39.3	8.0	3.5	30.3

[1]The average, minimum, maximum under total are based on the monthly values reported in this table.

TABLE 2-14
TOWN OF NANTUCKET
CWMP/FEIR
SURFSIDE WWTF PERFORMANCE - 2002

			Influent Quality			Effluent Quality					Sludge			
Month	Avg. Flow (mgd)	Oil & Grease	BOD (mg/L)	TSS (mg/L)	Total Solids (mg/L)	pH	Temp. (C)	BOD (mg/L)	TSS (mg/L)	Total Solids (mg/L)	Gals. (x 1000 gal)	Lbs (x 1000 lbs)	Feed Solids (%)	Cake Solids (%)
January	0.83	29.5	120	91	560	7.09	9.20	106	46	508	16.8	11.1	2.6	27.4
February	0.82	21.0	117	158	660	7.08	9.15	107	75	851	12.4	9.1	5.1	26.8
March	0.88	11.9	120	104	658	6.82	10.65	94	55	554	16.8	11.7	3.0	25.2
April	0.95	22.8	113	87	441	6.65	12.73	116	47	379	24.8	16.1	3.5	28.9
May	1.14	27.6	145	129	541	6.64	15.42	91	37	426	33.3	16.8	4.5	30.4
June	1.38	8.0	172	163	719	6.83	18.73	89	27	544	30.6	17.5	3.4	27.0
July	1.73	9.6	207	193	770	6.70	22.95	120	28	560	36.4	28.7	3.4	27.4
August	1.81	4.5	176	124	665	6.71	23.04	115	18	496	30.3	21.7	3.1	27.5
September	1.45	9.1	173	147	583	6.62	20.9	86	16	538	21.9	16.3	3.1	27.1
October	1.00	15.6	153	116	533	6.70	18.12	96	37	486	22.3	14.4	3.3	28.4
November	1.37	38.0	110	99	554	6.74	13.88	94	51	602	N/A	8.2	3.0	31.8
December	0.99	18.8	130	88	485	6.73	10.23	111	46	409	11.5	12.2	5.5	32.7
Total[1]	**14.35**										**257.1**	**183.8**		
Average	1.20	17.9	147	127	599	6.75	16.0	101	40	531	26.3	17.6	3.5	28.1
Minimum	0.82	4.5	110	87	441	6.62	9.15	86	16	379	11.5	8.2	2.6	25.2
Maximum	1.81	38.0	207	193	770	7.09	23.04	120	75	851	36.4	28.7	5.5	32.7

[1]The average, minimum, maximum under total are based on the monthly values reported in this table.

Evaluation of Process Equipment

The condition of all of the process equipment at the Surfside WWTF was evaluated. The equipment evaluation is based on a site visits, discussions with the WWTF staff and review of maintenance records. The serviceability rating is based on the following qualitative rankings show in Table 2-15.

**TABLE 2-15
TOWN OF NANTUCKET, MASSACHUSETTS
CWMP/FEIR
SURFSIDE WWTF SERVICEABILITY RATINGS**

Rating	Description
3	Good
2	Fair
1	Poor
0	Inoperative

Headworks

The Bar Rack, Parshall Flume and Aerated Grit Chamber are located in the Headworks. An evaluation of the Headworks equipment found of a badly corroded grit collector screw and retrievable aeration piping in need of replacement, and the need for aluminum plates instead of the grating currently in place. Currently a grating system is in place that allows odors to escape into the air while using aluminum plates would contain the odors and allow the odorous air stream to be treated in the existing odor control system. Table 2-16 shows the summary of equipment in the Headworks.

Solids Handling Building

Grit Dewatering System, Grit Pump, Septage Pump, Primary Sludge Pumps, Belt Filter Press Feed Pumps, Odor Control Equipment including Chemical Feed System and Air Compressor are located in the Solids Handling Building. The investigation of the Solids Handling Building concluded that the Cyclone Dewatering System and grit and septage pumps are in need of rehabilitation or replacement due to severe corrosion. Table 2-17 shows the summary of process equipment in the Solids Handling Building.

TABLE 2-16
TOWN OF NANTUCKET, MASSACHUSETTS
CWMP/FEIR
SURFSIDE WWTF EVALUATION OF PROCESS EQUIPMENT – HEADWORKS

Description	Qty	Manufacturer	Run Time (hrs)	Serviceability Rating	Nameplate	Comments
Flow Measuring Device	1	Sigma 950		3	---	- Primary measuring device is a 12” Parshall Flume
Grit Pump	1	Hayward Gordon	2,092	2.5	3”	
Retrievable Piping	1			0	---	- Located in Grit Chamber - Used for Air Distribution - Out of Service - Needs Replacement - Manufactured by Schloss
Grit Collector Screw	1			1	---	- Badly Corroded
Floor Grates	---	---	---	1	---	- Needs aluminum plate to replace grating covered by plywood for odor containment.

TABLE 2-17
TOWN OF NANTUCKET, MASSACHUSETTS
CWMP/FEIR
SURFSIDE WWTF EVALUATION OF PROCESS EQUIPMENT – PRIMARY CLARIFIERS

Description	Qty	Manufacturer	Run Time (hrs)	Serviceability Rating	Nameplate	Comments
Clarifier Drives	3	FMC	Min: 57,205 Max: 86,000	2	---	- Replace Flights, Sprockets and Chains as part of Upgrade
MCC	1	---	---	2	---	- Exterior of cabinets beginning to corrode

Sludge Management Building

Belt filter presses and ancillary equipment, plant water system and emergency generator are located in or near the Sludge Management Building. The location of the plant water system in the Sludge Management Building creates an unfavorable suction condition due to its significant distance from the water supply. This condition has caused the pumps to periodically become air bound. The belt filter presses are in very poor condition due to the significant amount of corrosion in the control panels, the frame, and the ancillary mechanical components. The air compressor is ongoing maintenance issue, and the tracking system requires frequent maintenance.

The WWTF generator is adjacent to the sludge management building and also faces minor corrosion of the base and frame. Do to the limited sludge storage capacity, longer dewatering operations will be required in the short term when the additional sludge from the Siasconset WWTF is processed at the facility. Table 2-18 shows the summary of equipment in the Sludge Management Building.

Odor Control System

The evaluation of process equipment pertaining to odor control identified the same problem as other equipment. The air purification towers contain electrical controls and fan motors that are severely corroded. The prechlorination pumps are also corroding. Table 2-19 shows the summary of equipment for Odor Control. At this time, the Nantucket WWTF does not use a SCADA system. SCADA would be beneficial to this facility as a way of monitoring operations and alarms at the WWTF as well as at the remote pump stations.

It is evident that the Nantucket WWTF has a corrosion problem with most of its above ground equipment. The most likely cause of this problem is the salt water blowing off the ocean. In process areas (such as the Sludge Management Building) the presence of hydrogen sulfide is also contributing to the problems with corrosion. In any means, it is necessary to rehabilitate or replace this equipment.

TABLE 2-18
TOWN OF NANTUCKET, MASSACHUSETTS
CWMP/FEIR
SURFSIDE WWTF EVALUATION OF PROCESS EQUIPMENT – SOLIDS HANDLING BUILDING

Description	Qty	Manufacturer	Run Time (hrs)	Serviceability Rating	Nameplate	Comments
Cyclone	1	Krebs	2,092	1	---	- Located in Grit Room - Supplied by Schloss - Corroded
Inplant Pump Station	1	Hydromatic	---	1.5	5 hp	- Heavily corroded
Septage Pumps	1	Hayward Gordon	Grit Rml: 2,092 Septage: 1,256	2.5	200 gpm@24' 5 hp	- Dual purpose pump - Variable speed - Used for grit and septage
Sludge Pumps (Primary Sludge)	3	Penn Valley	Min: 2,425 Max: 2,872	2.5	300 rpm 80 gpm	- Double Disc
Sludge Pumps (Belt Press Feed)	2	US Motor	Min: 2,897 Max: 12,903	2	---	- Progressing Cavity - Variable speed
De-Humidifier	1	Dryomatic	---	2.5	---	- Currently in use - Possible location for plant water
Blowers (Aerated Sludge Holding)	2	Dresser	Min: 24,380 Max: 56,860	2.5	---	

TABLE 2-19
TOWN OF NANTUCKET, MASSACHUSETTS
CWMP/FEIR
SURFSIDE WWTF EVALUATION OF PROCESS EQUIPMENT – SLUDGE MANAGEMENT BUILDING

Description	Qty	Manufacturer	Run Time (hrs)	Serviceability Rating	Nameplate	Comments
Plant Water Pumps	3	Systecon	1: 10,806 2: 6,320 3: 4,097	2	---	- Pumps periodically become air bound due to unfavorable suction conditions
Polymer Feed System	2	Milton Roy/ Acrison	---	2	100 gph	- 6,000 lb/yr
Belt Filter Presses	2	Roedigger	---	1	1.0 meter	- Control panels badly corroded - Air compresser for tracking system requires frequent maintenance - Frame and ancillary mechanical components corroded.
Plant Generator	1	Kohler	777	2.5	92 hp	- Some corrosion on base and frame

Table 2-20 shows the summary of Primary Clarifier equipment. Table 2-21 shows the summary of equipment in the CEPT Building. Table 2-22 shows the summary of all miscellaneous equipment.

Siasconset Wastewater Treatment Facility

The existing Siasconset sewerage system, which dates back in part as far as 1914 and serves the densely built up area of the village along the easterly end of the island. It extends to Sankaty Head Lighthouse on the north, Front Street on the east, Ocean Avenue on the south, and Burnell Street on the west. The system discharges all wastewater to four rapid sand infiltration basins located off of Low Beach Road via a 12-inch diameter gravity sewer. Currently, all wastewater flow from the Siasconset area passes through a flow-metering manhole, abandoned screening chamber and a settling tank prior to discharge at the basins. The flow metering equipment consists of a parshall flume and level element retrofitted into a manhole.

The United State Coast Guard (USCG) also has existing wastewater disposal facilities in the same area as the existing Town facilities. The USCG sewer infrastructure consists of gravity sewer on USCG property, which services the main buildings off the end of Low Beach Road, and the housing on Silver Street (cul-de-sac off of Low Beach Road). All wastewater is discharge to two rapid sand infiltration basins via a 10-inch diameter gravity sewer that runs from Low Beach Road cross-country to the basins.

The existing effluent beds noted above have been improved, however untreated wastewater is still being discharged to the ground through the rapid infiltration basins due to abandonment of the Siasconset WWTF project in 1990 because of coastal erosion concerns.

TABLE 2-20
TOWN OF NANTUCKET, MASSACHUSETTS
CWMP/FEIR
SURFSIDE WWTF EVALUATION OF PROCESS EQUIPMENT – ODOR CONTROL

Description	Qty	Manufacturer	Run Time (hrs)	Serviceability Rating	Nameplate	Comments
Hypochlorite Storage Tanks	2	Poly Processing	---	3	---	- Tanks hold 3,000 gallons each - Delivery time is once every two weeks - 50 gpd used for scrubbers - 250 gpd used for prechlorination - Hypochlorite only used between 5/15-11/15
Scrubbers	2	Quad	---	2.5	Chemtact	- Consists of 50 hp compressed air system manufactured by Sull Air
Air Purification Towers	2	Calgon	---	2	---	- Vessels appear to be in good condition - Electrical controls and fan motors are severely corroded
Mist Chamber Fans	2	Hartzell	---	2	--	
Carbon Filtration Fans	2	New York Blowers	---	2	20 hp	- Odor control for Composting not in use - Odor control for sludge management system is in use
Potassium Permanganate		---	---	2	---	- 25,000 lbs used per year
Prechlorination Pumps	2	Hydroflo	---	1.5	20 gph	- One pump for each scrubber - Exterior of pumps are corroding

TABLE 2-21
TOWN OF NANTUCKET, MASSACHUSETTS
CWMP/FEIR
SURFSIDE WWTF EVALUATION OF PROCESS EQUIPMENT – CEPT BUILDING

Description	Qty	Manufacturer	Run Time (hrs)	Serviceability Rating	Nameplate	Comments
Cationic Polymer System	1	Acrison	---	2.5	---	- Not in Use
Anionic Polymer System	1	Acrison	---	2.5	---	- Amount used for chemically enhanced primary treatment is 25 lbs/yr - Amount used for de-watering is 6,000 lbs/yr
Polymer Pumps	3	Milton Roy	---	2.5	---	- One pump for each system and one for standby use
Potassium Permanganate Tank	1	Poly Processing	---	2.0	---	- 2,000 gallons of storage available - 0.5% solution is used - Venturi system used for mixing
Aluminum Salt Tanks	2	Poly Processing	---	2.5	---	- Tank 1 capacity is 3,000 gallons - Tank 2 capacity is 1,000 gallons - Tank 1 stores Aluminum Salts - Tank 2 originally used to store Sodium Hydroxide, currently used to store Aluminum Salts - Approximately five deliveries per year (mid May, mid June, mid July, late August & late September) - Usage: 25,000 gallons/ year
Aluminum Salt Pumps	3	Milton Roy	---	2.5	#1 & 2: 8.8 gph #3: 5.2 gph	- Pump 3 was originally used for Sodium Hydroxide

TABLE 2-22
TOWN OF NANTUCKET, MASSACHUSETTS
CWMP/FEIR
SURFSIDE WWTF EVALUATION OF PROCESS EQUIPMENT – MISCELLANEOUS

Description	Qty	Manufacturer	Run Time (hrs)	Serviceability Rating	Nameplate	Comments
Compost Blowers	10	Dayton	Min: 1,652 Max: 7,891	2	Model: 4C329	- Not In Use - High Pressure Direct Drive Blowers
Screener	1	LinDig	---	1.5	---	- Was used for composting - Out Of Service
Sludge Mixer	1	SSI	--	2	---	- Was used for composting - Not In Use
SCADA	---	---	---	---	---	- Not currently in place - Could be useful at this facility - Current alarm and indication panel uses relays and indicator lights.

As noted above severe storms caused significant erosion that postponed construction of the coastal Siasconset Wastewater Treatment Facility and only minor modifications being made to the existing infiltration basins in 1991. Several years after the minor modifications, Earth Tech was engaged by the Town of Nantucket to evaluate the alternatives for providing wastewater treatment and disposal for the Siasconset area of the Island.

As part of the Plan, a Needs Analysis was conducted to investigate existing conditions and to project future needs. Evaluations of topography, watersheds, natural resources, surficial geology, soils, existing land use and populations trends (sewered versus non-sewered, seasonal versus year round), water supply systems and wastewater conveyance and treatment systems were conducted and future wastewater flows were projected. It was concluded that in the year 2022, a projected peak seasonal population of 3,500 individuals would require a facility with a design average flow of about 220,000 gpd. It was also projected that the facility would meet effluent limit concentrations of 10 mg/L for BOD_5, TSS, and Total Nitrogen.

Feasible options for regional wastewater treatment and disposal at the existing Surfside Wastewater Treatment Facility were also evaluated. These options included the investigation of force main routes, pumping station requirements, environmental issues, and an analysis of existing versus projected wastewater flows at the Surfside Wastewater Treatment Facility. One of the major elements evaluated in the Facilities Plan was the alternative of treatment and disposal of wastewater within the Siasconset Planning area versus the transport of wastewater to the Surfside Wastewater Treatment Facility for treatment and disposal. Significant issues included site availability within the planning area, environmental impacts, and costs. The EIR addressed specific environmental issues, including rare and endangered species, and coastal erosion. The EIR also included detailed cost analyses of the treatment facility and sewering options.

On-site treatment and disposal was selected as the solution for the Siasconset. Sequencing Batch Reactors (SBR) were selected as the secondary treatment process for the facility. Multiple basins will be installed to allow the Operator flexibility in the number of basins to be operated during each particular season. It is anticipated that two or three larger volume basins will be operated during summer months and one or two smaller volume basins operated during winter months. The process has been designed not only to treat the projected future summer flows and loadings, but also to adequately treat the initial winter low flow and loadings.

The entire project includes construction of an influent pumping station, wastewater treatment facility and infiltration basins. The influent pumping station is located near the basins and will pump all of the wastewater to the new wastewater treatment facility. The raw wastewater will pass through a channel grinder prior to entering the pump station. Wastewater will then flow through the following processes: influent metering structure, primary clarifiers, SBRs, post equalization, effluent filters, UV disinfection system and an effluent metering structure. All treated wastewater is then discharged to the infiltration basins.

The design includes a totally covered process in order to maximize odor control at the facility. A biofilter system for treatment of the odorous air stream was chosen due to the fact that it has a low profile (below grade organic bed) and does not require any chemicals for operation.

The system has been designed to provide complete treatment without the use of chemicals. This was a requirement of the Town because of the fact that the facility is located on an island and will not be fully manned. The Siasconset Wastewater Treatment Facility will be operated as a satellite facility to the existing Surfside Wastewater Treatment Facility. A supplemental alkalinity (sodium bicarbonate) chemical feed system has been included as a safety measure for the secondary treatment process, but it is not anticipated that this system will be needed for normal operation of the process.

The groundbreaking for this facility occurred in November 2002 with an estimated completion date of July 2004.

8. Potential Reuse Opportunities

As discussed previously in this section, typically treated effluent is discharged either to a surface water body or to the ground with percolation through the soil to the groundwater. A third option, discussed in this section, is to reuse the wastewater for non-potable needs. Some communities, throughout the United State, have adopted policies on wastewater reuse in an effort to conserve valuable water resources and provide a means for the disposal of treated effluent. A properly developed wastewater reclamation program can provide valuable benefits to both the municipality and the water/wastewater system users. Fee structures can be developed whereby consumers pay a flat fee or no fee at all for unlimited use of reclaimed wastewater for lawn irrigation and other non-potable uses. If such a structure includes fees based on usage for potable water, consumers can realize an economic benefit by using reclaimed wastewater for irrigation purposes rather than potable water. Such a pricing scheme would also encourage water conservation.

The agricultural, industrial, and commercial consumers can realize similar economic benefits. With proper treatment, reclaimed wastewater demonstrates few health risks, while providing the community with a solution to their wastewater disposal problem.

The Water Environment Federation explored water reuse issues at their Annual Conference and Exposition in October 1998. Specifically, water reuse innovations and alternatives were presented as they applied to numerous Florida communities. Such technologies include water reuse for landscaping, agricultural uses, and fire protection. Following is a discussion of these alternatives, and commercial/industrial water reuse applications as they may be applied to the Town of Nantucket.

Landscaping

Reclaimed wastewater has been successfully used as irrigation water for residential, commercial, and industrial applications. Reclaimed water has several advantages over the use of potable water for irrigation. In St. Petersburg, Florida, it was shown that the application of 1½ inches of reclaimed water per week provided approximately 50 percent of the nitrogen, phosphorus, and potassium requirements for horticultural and agricultural purposes. This resulted in reduced fertilizing costs to the consumer. A study completed by St. Petersburg indicated that when chloride levels in the reclaimed wastewater were kept below 400 mg/L, plants being irrigated with reclaimed water showed significantly more growth than those plants irrigated with water from the city's potable water system.

Agricultural Uses

The City of Orlando, Florida has achieved success in wastewater reuse through the implementation of Water Conserv II, a comprehensive program whereby water is reused in agricultural irrigation systems and aquifer recharge. In areas with a significant agricultural industry, wastewater reuse can substantially reduce the amount of wastewater to be disposed of by traditional surface or subsurface application procedures. Depending on demand, reclaimed wastewater can be given to agricultural consumers free of charge or for a nominal fee, thereby providing an incentive to farmers by decreasing costs and providing an alternative for wastewater disposal. Benefits from the nutrient enriched reclaimed wastewater are similar to those cited for wastewater reuse for landscaping purposes.

Fire Protection

The use of reclaimed wastewater for fire protection involves unique construction, permitting, and regulatory limitations. For such a system to be developed, the Town of Nantucket would have to work closely with local, state, and federal environmental and regulatory groups to develop a policy for the design of a facility utilizing reclaimed wastewater in its fire protection system. Initial design considerations would include delineating the potential uses of the facility for which the fire protection system is being designed (food preparation, retail outlet, industrial, etc.), examining construction constraints, and addressing regulatory concerns (for example, would building occupants be required to sign an agreement prohibiting them from salvaging certain items in the event of a fire). Development of this alternative could require substantial investment of time and resources, as this technology is relatively new.

Commercial/Industrial Uses

Commercial/Industrial consumers can use reclaimed wastewater for process water and other non-potable applications within their facilities, and for irrigation outside their facilities as described above. Commercial/Industrial consumers could also prove instrumental in the implementation of reclaimed wastewater in fire protection systems. The specific nature of any given industrial application would require that the industrial water reuse program be tailored to meet the specific needs of each facility.

Health concerns of the public will need to be addressed to promote acceptance of a reclaimed wastewater system. St. Petersburg, Florida, has had no reported cases of illness or disease resulting from the use of reclaimed water since the inception of their reuse program in the 1970s. This fact is significant in that homeowners have control over their use of reclaimed water, and many of the residents of St. Petersburg are elderly and thus more susceptible to disease. The specific health risks associated with the wastewater produced in the Town of Nantucket would have to be studied and addressed as part of the development of a wastewater reclamation program.

The drawbacks of reclaimed water use can be mitigated through careful planning. If demand is anticipated to exceed supply, the Town may consider installing metering devices and developing a rate structure so that usage can be monitored and controlled. The Town would need to develop the rate structure in conjunction with the potable water rate structure to ensure that incentives are still present to encourage consumers to use reclaimed wastewater for their non-potable water needs. Should the supply of reusable water exceed the demand, the Town would have to implement other wastewater disposal alternatives to supplement reuse activities. Consumers would have to be educated as to the benefits and proper use of a reclaimed wastewater system. For example, use of reclaimed water is not recommended for car washing, as the high mineral content in the wastewater will leave a mineral deposit on vehicles. Such educational objectives could be included in the water conservation plan.

Finally, construction costs must be minimized. Installing a new reclaimed wastewater distribution system in an area can be quite costly due to restoration costs associated with installing the necessary piping. However, if construction is coordinated with other projects, such as the construction of a wastewater collection system, economic benefits could be realized. If such construction activities can be coordinated, it may make economic sense to install dry lines in areas of new development to accommodate the reclaimed water supply when it becomes available.

9. Residuals Disposal and Reuse

In this section, technologies are reviewed for possible application in meeting the Town of Nantucket's sludge management needs if a new wastewater treatment facility is constructed. A description of each technology option is presented, focusing on the process, products and/or sidestreams, relative advantages and disadvantages. Some of these, such as dewatered sludge landfilling, are considered to be "disposal" technologies because sludge, as a waste material, is being disposed. Others are often referred to as "beneficial-use" technologies because they result in a product form of sludge that can be recycled for beneficial purposes. For example, composting processes sludge into humus-like material that contains plant nutrients and is an excellent soil conditioner. Some technologies, such as incineration, have both disposal and beneficial aspects. Ash, the end product of incineration, is usually disposed in a landfill. However, heat produced during combustion can also be recovered and is sometimes used to generate electricity. Methane recovery from sludge digestion will not be considered since it would only be provided with anaerobic digestion facilities. These facilities are typically not economical for smaller wastewater treatment facilities with flows less than 5.0 MGD.

Incineration with Ash Landfilling

Incineration reduces sludge to ash and gases, decreasing the volume for disposal by approximately 95 percent. Sludge ash is a sterile, inorganic, non-odorous powdery material that is typically conditioned with water to minimize blow-away during handling and landfilling. Incineration exhaust gas contains pollutants, which must be treated with emissions control equipment prior to release to the atmosphere.

Federal and state regulations govern both ash handling and air pollution controls. The ash must meet the standards set forth in the RCRA toxicity characteristic leaching procedure (TCLP) prior to landfilling. Exhaust gases must meet Federal New Source Performance Standards (NSPS), National Emissions Standards for Hazardous Air Pollutants (NESHAP) and the 40 CFR Part 503 regulations with respect to emissions of hazardous air pollutants, plume capacity and flue gas temperature and oxygen content.

Advantages of incineration as a sludge management technology are that it is a well-established and proven technology; the resultant ash is sterile and odor-free and requires minimal landfill volume; large quantities can be processed and disposed of on a continuous basis; and storage and transport requirements are minimal.

Disadvantages are that: it is a relatively complex technology requiring skilled operators; capital and operating costs, including costs for emission control, are high; and two sidestreams are produced, ash and emissions, which require additional treatment and handling. Odor production is often associated with the use of this technology due to the relatively low temperature combustion practiced at many existing incinerator facilities. However, combustion at high temperatures will be required to comply with future emissions standards, which should largely eliminate odor releases.

Heat-Drying with Distribution and Marketing

Heat-drying is a beneficial-use technology which uses heat from either flue gases or steam heat exchangers to evaporate moisture from dewatered sludge and produce an organic fertilizer/soil conditioner for distribution and marketing. A sidestream of exhaust gases is also produced which must be treated by emissions control equipment before discharge to the atmosphere.

Both the heat-dried product and the emissions resulting from the process are subject to federal and state regulations relating to land application of sludge. The Federal NSPS, the NESHAP, 40 CRF Part 503 regulations, and state regulations would regulate the release of exhaust gases from heat drying.

The main advantage of heat drying is that it produces a beneficial, marketable product which is less bulky and potentially more valuable than compost because of its higher nutrient content. Thus, transportation to more distant markets is sometimes practical. In addition to local marketing of the product, it can be distributed through brokers to large users such as citrus growers and tree farmers. Heat-dried product can be used as a substitute for chemical fertilizers and has numerous landscaping and horticultural applications.

Disadvantages are that it is a relatively complex and expensive technology that requires skilled operators, strict emissions/odor control, and efficient storage/handling/and marketing of a product with primarily a seasonal demand. Another factor to consider is competition from heat-dried products produced outside of the Town of Nantucket (e.g. Boston, New York City and possibly some other communities that formerly relied on ocean dumping).

Composting with Distribution and Marketing

Composting is a beneficial-use technology, which accelerates the biological decomposition of dewatered sludge through aeration and the addition of volatile organic material to produce a humus-like soil conditioner for distribution and marketing. The composting process generates two sidestreams which require treatment: a liquid sidestream consisting of condensate and leachate and an exhaust air sidestream which must be treated with odor control equipment.

Compost can be marketed to various industries and users. Compost can be used for the following:

Greenhouse, Nursery, and Turfgrass Use: To provide a growing medium and soil amendment in a mix with other media for potting non-food chain plants, for growing and transplanting nursery stock, and for soil enhancement prior to new seeding and maintenance.

Golf Courses and Landscaping: To provide organic matter during maintenance and fertilizing of the grasses, and as a soil amendment.

Landfills: As an amendment to soil used for final cover material and for subsequent slope management.

Topsoil and Land Reclamation: As a soil amendment to improve the growing ability, nutrient content, and water retention of poor, sandy, gravel type soils.

The main advantages of composting are the relative simplicity of the technology, the fact that it produces a beneficial and marketable product from sludge waste, and that it can aid in meeting solid waste management needs by utilizing tree trimmings and other yard wastes in the sludge composting process.

Disadvantages include potential difficulties with odor control, dependence on a successful marketing and distribution program, and substantial storage/handling requirements for a bulky product with a primarily seasonal demand. Additional factors to consider include availability of suitable land for compost application and competition for a limited market.

Alkaline Stabilization

Alkaline stabilization is a beneficial-use technology which uses exothermic (heat producing) reactions resulting from mixing alkaline materials with dewatered sludge to evaporate moisture and kill pathogens and odor-causing bacteria, while fixating (chemically binding) metals to produce an organic soil conditioner/soil substitute. Alkaline-stabilized sludge can be used for agricultural, landscaping, and land reclamation purposes. Alkaline stabilized sludge is different than compost. The chief difference is that it has a much higher inert solids content due to the chemicals added during processing.

The main advantages of alkaline stabilization are that it is a relatively simple technology and that it produces a usable material without generating sidestreams. Disadvantages are the need for a continuous supply of alkaline material, substantial storage and handling requirements, and reliance on dependable outlets for product distribution.

Agricultural or Non-Agricultural Land Application

Land application is a beneficial-use technology in which liquid or dewatered sludge is applied directly to the land to promote agricultural or non-agricultural plant growth. Land application can also be a sludge disposal technology, when sludge is applied at higher than agronomic rates to dedicated sites. Land-applied sludge is usually pretreated for pathogen reduction and stabilized by lime conditioning or aerobic or anaerobic digestion. If the sludge is applied properly, potential sidestream problems (i.e. odors, surface run-off, and leachate) can be averted.

Advantages of land application are that it is a simple technology based on beneficial-use and little capital investment is required. Disadvantages are that: large usable land areas must be available; operation is weather- and season-dependent, necessitating provisions for sludge storage; and careful application and monitoring are required to control problems with odors, surface runoff, and leachate.

Dewatered Sludge Landfilling (Monofilling)

Monofilling is the disposal of sludge by burial in a dedicated sanitary landfill. Preprocessing typically consists of dewatering and may include anaerobic digestion or chemical treatment for stabilization. Proper design and operation is required to control leachate, volatile organics emissions, and methane gas seepage. Landfilling of dewatered sludge is regulated by the RCRA toxicity characteristic leaching procedure (TCLP), 40 CFR Part 257 requirements for landfills, and by state regulations governing landfilling. Sludge rarely fails the TCLP test and so is usually classified as non-hazardous.

Advantages of monofilling include simple operation, minimal processing and low costs. The overwhelming disadvantage is the need for suitable landfill sites to place the dewatered sludge.

Co-Disposal

Co-disposal is the treatment and/or disposal of sludge in conjunction with municipal solid waste (MSW). Possibilities include co-incineration, co-composting, and landfill co-disposal. While co-incineration has been successfully practiced in other countries, there are only two large-scale operations in the United States – one located in the Western Connecticut region at Stamford, the other in Duluth, Minnesota. Western Connecticut also has a very small co-incinerator located in New Canaan. Typically, dry sludge solids are burned at a rate of 1 dry pound for every 5 to 8 pounds of MSW; the Stamford facility operates at a 1 to 20 ratio.

Advantages of co-incineration are the reduction in combined costs of incinerating sludge and MSW separately and the process efficiency, which allows complete burning of both materials without the use of auxiliary fossil fuels (and provides an excess of heat for steam generation if desired). Disadvantages are the dependence on a supply of MSW and coordination of sludge quantities with MSW quantities during the co-incineration process.

Co-composting sewage sludge with MSW is a co-treatment technology which has had limited acceptance in the United States in the past, but is beginning to receive interest. The process requires presorting and pulverization of MSW before mixing it with liquid sludge containing 5 to 12 percent solids. A 2 to 1 ratio of solid waste to sludge is the recommended minimum. Although beneficial product results, the quality of the compost is inconsistent and generally inferior to compost made from sewage sludge alone.

The most common co-disposal practice is sanitary landfilling, which is advantageous because of the complimentary absorption characteristics of the solid waste and the soil conditioning characteristics of the sludge. Co-disposal costs are typically lower than the costs of a dedicated sludge landfill due to the economy of scale. Disadvantages of utilizing a co-disposal site include operational problems associated with mixing refuse and sludge, increased leachate and odor potential, and site capacity concerns.

The Town of Nantucket dewaters sludge at the Surfside Wastewater Treatment Facility. Although the facility has the capability to compost the dewatered sludge using the aerated static pile method, the Town is currently hauling it to a Municipal solid waste composting facility located at the Department of Public Works in Madaket. The municipal solid waste composting facility in a privately owned and operated under a 25-year contract.

Contract Disposal Alternatives

An alternative to the Town of Nantucket disposing its own sludge is to have the material transported to a private contract disposal facility. The sludge could be transported in cake form, with a dump truck or a container truck using watertight bodies. Dump trucks typically have a normal capacity of approximately 12 cubic yards, though smaller and larger sizes are available. Container capacities typically average approximately 30 cubic yards, though smaller and larger sizes are also available. Containers can be custom made in different sizes, shapes, and dumping configurations to suit the needs of a specific location.

The sludge could also be thickened and pumped into a tank truck in liquid form for disposal at a facility, which accepts liquid sludge. The liquid sludge is transported in tank trucks, which typically hold approximately 6,500 gallons (though smaller and larger capacities are available).

Various facilities are available throughout the New England area. Wastestream Environmental (WSE), with facilities located in Fitchburg, Upper Blackstone, Mattabassett, and Hartford; New England Treatment Company (NETCO), located in Woonsocket, Rhode Island; Waste Management, Inc. in Rochester, New Hampshire; and Naugatuck Treatment Company in Naugatuck, Connecticut are all contract disposal facilities in the New England region. Costs at these facilities depend on how the sludge is transported (in liquid or solid form), and the sludge has to meet various criteria established by each facility. The cost will be dependent on the specific characteristics of the sludge, but typically range from $0.10 to $0.20 per gallon for liquid sludge and $90 to $100 per wet ton for dewatered sludge. This fee typically covers the tipping fee at the facility but does not cover the transportation costs from the Island.

Innovative Technologies

"Innovative technologies" is the generic term applied to a range of unconventional sludge disposal technologies. In general, these technologies have been demonstrated on a pilot scale or small facility basis, but have not seen widespread use. End products range from a compost-like material to a concrete aggregate substitute.

The following technologies are some of the more widely known, if not widely practiced innovative technologies.

Aggregate Production

This type of process is available in various forms and is generally similar to conventional incineration in that sludge volatiles are burned, leaving only the inert fraction. In one of the process variations, sludge is burned in a special furnace at very high temperatures to induce slag formation. Instead of ash, liquid slag is removed from the bottom of the furnace and dropped into a quenching medium, such as water, forming a stable, fused, glassy solid, suitable for reuse as aggregate. This process is being marketed by World Envirotech, and is used at a wastewater facility in Monticello, New York.

Earthworm Conversion, or Vermiculture

This is a stabilization process by which earthworms consume the organic material in municipal wastewater sludge. The product of Vermiculture (i.e., the worm castings) may be used as a soil conditioner, similar to compost. This technology is still in the experimental stage. There are no significant facilities in the United States.

Fuel from Sludge

The conversion of sludge solids to oil and char under pressure has been proven technically feasible under laboratory conditions. However, commercialization and scale-up have been estimated to be prohibitively expensive.

Deep Well Oxidation

This process uses conventional oil well drilling technology to position an annular reactor in a vertical position up to one mile below grade. The process takes advantage of the great hydraulic head generated by the liquid column, along with the application of head and oxygen, to oxidize the sludge organics. A small prototype facility was constructed and operated with mixed results in Longmont, Colorado early in the 1980's. Privatized facilities using modifications to the original concept are under evaluation in Houston and Detroit. Chief disadvantages of the process are corrosion or scaling of the reactor surfaces and generation of a side stream with a high soluble organics content, which requires additional treatment. The main advantages are the generation of a relatively inert ash-like product, with low land area requirement.

As with the conventional technologies described previously, any innovative technology would also be subject to corresponding federal and state regulations governing processing and distribution. For example, the aggregate production process would be regulated in a manner similar to incineration, focusing on air quality impacts.

Each of the innovative technologies described above has its unique advantages. For example, the aggregate production process solves the problem of ash disposal resulting from conventional incineration, assuming a market for the aggregate material is found.

The major disadvantage of all innovative technologies is that they are untried and unproven on a large scale in the United States. High costs and operational problems are generally incurred in operating a facility based upon a new unproven process.

A prime example of this is the difficulties experienced by the City of Los Angeles with its innovative oil-based sludge drying system used at the Hyperion Treatment Plant, which represented the first large-scale adaptation of this technology for wastewater sludge in the U.S.

D. WASTEWATER REUSE FOR ARTIFICIAL RECHARGE

1. General

This section provides an overview of salient aspects, generally of a technical nature, applicable to wastewater reuse for artificial recharge. Legal, institutional, and economic aspects are not a part of this discussion. These aspects include (a) desirable wastewater treatment levels, and (b) treatment technologies that represent components of process train(s), which will produce effluent suitable for artificial ground water recharge. This chapter also provides brief descriptions of relevant representative projects currently in operation, which produce wastewater effluents for artificial recharge or potable water reuse.

2. General Requirements For Wastewater Usage For Artificial Recharge

National Research Council's report on Ground Water Recharge Using Waters of Impaired Quality (1994) has extensively researched the aspects of wastewater usage for artificial recharge. The following pertinent information is summarized using the material presented in that report.

Based on current information, wastewater used to recharge the ground water must receive a sufficiently high degree of treatment (minimum secondary treatment) prior to recharge so as to minimize the extent of any degradation of native ground water quality, as well as to minimize the need for and extent of additional treatment at the point of extraction. After proper treatment, the wastewater is ready for recharge, either through surface spreading and infiltration through the unsaturated zone or by direct injection into ground water. Recharge by infiltration takes advantage of the natural treatment processes, such as biodegradation of organic chemicals that occurs as water moves through soil. The quality of the water prior to recharge is of interest in assessing the possible risks associated with human exposures to chemical toxicants and pathogenic microorganisms that might be present in the source water. Although one can reasonably expect that such constituents will often be reduced during filtration through the soil, as well as subsequently in the aquifer, a conservative approach to risk assessment would assume that toxicants and microorganisms are not completely removed and some are affected only minimally prior to subsequent extraction and use. Thus when recharge water is withdrawn later for another purpose, it may require some degree of post treatment, depending on its intended use.

There are several operational issues that must be addressed on a site-specific basis. These concerns are related to project sustainability, treatment needs, public health impacts, and economic and institutional constraints. In the short-term, project sustainability is controlled by operating and managing the system so as to prevent or control clogging. Long-term sustainability is dependent on finding the best combination of pretreatment, soil-aquifer treatment, and post treatment for determining whether the wastewater used for recharge will exceed the treatment and removal capacity of the soil-aquifer treatment system.

Constituents of concern in municipal wastewater include organic compounds, nitrogen species, pathogenic organisms, and suspended solids. Treatment processes are readily available and have been used successfully to treat municipal wastewater effluent to levels acceptable for various recharge applications. However, even when treated to a very high degree, disinfection of the effluent with chlorine results in the formation of disinfection by-products (DBPs) with the residual organic compounds. These DBPs are of concern if the recovered ground water is to be used for potable purposes. Raw municipal wastewater may include contributions from domestic and industrial sources, infiltration and inflow from the collection system, and, in the case of combined sewer systems, urban stormwater runoff.

The occurrence and concentration of pathogenic microorganisms in raw wastewater depend on a number of factors, and it is not possible to predict with any degree of assurance what the general characteristics of a particular wastewater will be with respect to infectious agents.

Healthy individuals do not normally excrete viruses for prolonged periods, and the occurrence of viruses in municipal wastewater fluctuates widely. Viral concentrations are generally highest during the summer and early autumn months. Viruses as a group are generally more resistant to environmental stresses than many of the bacteria, although some viruses persist for only a short time in municipal wastewater.

Dissolved inorganic solids (total dissolved solids or salts, TDSs) are not altered substantially in most wastewater treatment processes. In some cases, they may increase as a result of evaporation in lagoons or storage reservoirs. Therefore, unless wastewater treatment processes specifically intended to remove mineral constituents are employed, the composition of dissolved minerals in treated wastewater used for ground water recharge can be expected to be similar to the composition in the raw wastewater.

Based on the information collected by numerous researchers, the following treatments for the two types of ground water recharge methods are considered desirable: (1) If the wastewater is indirectly discharged to the aquifer, the wastewater should receive secondary treatment followed by nitrification/denitrification, sand filtration, and disinfection; and (2) If the wastewater is used for direct injection to the aquifer, the wastewater should receive secondary treatment followed by sand filtration, a membrane process (such as micro-filtration/reverse osmosis, or similar treatment), and disinfection. It is assumed that if a membrane process is used, nitrification/denitrification will not be required because the membrane process will remove nitrogen compounds present in the wastewater.

3. Wastewater Treatment Levels and Technologies

General

Wastewater treatment levels are generally classified as preliminary, primary, secondary, tertiary, and advanced. The nature of each level of treatment is discussed in the following sections.

Primary Treatment

The first step in treatment, sometimes referred to as preliminary treatment, generally consists of the physical processes of screening, or comminution, and grit removal.

Past this initial screening, primary treatment consists of physical processes to remove settleable organic and inorganic solids by sedimentation and floating materials by skimming. These also remove some of the organic nitrogen, organic phosphorus, and heavy metals. Primary treatment, together with preliminary treatment, typically removes 50 to 60 percent of the suspended solids and 30 to 40 percent of the organic matter. Primary treatment does not remove the soluble constituents of the wastewater. Primary treatment has little effect on the removal of most biological species present in wastewater. However, some protozoa and parasite ova and cysts will settle out during primary treatment, and some particulate-associated microorganisms may be removed with settleable matter. Primary treatment does not reduce the level of viruses in municipal wastewater.

While primary treatment by itself generally is not considered adequate for ground water recharge applications, primary effluent has been successfully used in soil-aquifer treatment systems at some spreading sites where the extracted water is to be used for non-potable purposes.

A disadvantage of using primary effluent is that infiltration basin hydraulic loading rates may be lower because of higher suspended solids and weaker biological activity on and in the soil of the infiltration system. Also, too much organic carbon in the recharge water can have adverse effects on processes that occur in the soil and aquifer systems. In most cases, wastewater receives at least secondary treatment and disinfection, and often tertiary treatment by filtration, prior to augmentation of non-potable aquifers by surface spreading.

Secondary Treatment

Secondary treatment is intended to remove soluble and colloidal biodegradable organic matter and suspended solids (SS). In some cases, nitrogen and phosphorus also are removed. Treatment consists of an aerobic biological process whereby microorganisms oxidize organic matter in the wastewater. Several types of aerobic biological processes are used for secondary treatment, including activated sludge, trickling filters, rotating biological contactors (RBCs), and stabilization ponds. Generally, primary treatment precedes the biological process; however, some secondary processes are designed to operate without sedimentation; e.g., stabilization ponds and aerated lagoons.

Tertiary Treatment

The treatment of wastewater beyond the secondary or biological stage is sometimes called tertiary treatment. The term normally implies the removal of nutrients such as phosphorus and nitrogen, and a high percentage of suspended solids. However, the term tertiary treatment is now being replaced in most cases by the term advanced wastewater treatment, which refers to any physical, chemical, or biological treatment used to accomplish a degree of treatment greater than that achieved by secondary treatment.

Advanced Wastewater Treatment

Advanced wastewater treatment processes are designed to remove suspended solids and dissolved substances, either organic or inorganic in nature. Advanced wastewater treatment processes generally are used when a high-quality reclaimed water is necessary, such as for direct injection into potable aquifers. The major advanced wastewater treatment processes associated with ground water recharge are coagulation-sedimentation, filtration, nitrification-denitrification, phosphorus removal, carbon adsorption, and reverse osmosis.

Coagulation-Sedimentation

Chemical coagulation with lime, alum, or ferric chloride followed by sedimentation removes suspended solids, heavy metals, trace substances, phosphorus, and turbidity. Viral inactivation under alkaline pH conditions can be accomplished using lime as a coagulant, but pH values of 11 to 12 are required before significant inactivation is obtained.

Filtration

Filtration is a common treatment process used to remove particulate matter prior to disinfection. Filtration involves the passing of wastewater through a bed of granular media, which retain the solids. Treatment of biologically treated secondary effluent by chemical coagulation, sedimentation, and filtration has been demonstrated to remove more than 99 percent of seeded poliovirus. This treatment chain reduces the turbidity of the wastewater to very low levels, thereby enhancing the efficiency of the subsequent disinfection process.

The primary purpose of the filtration step is not to remove viruses, but to remove protozoa and helminth eggs and other suspended matter that may contain adsorbed or enmeshed microorganisms, thereby making the disinfection process more effective.

Chemical coagulation and filtration, followed by disinfection, can remove or inactivate 5 logs (99.999 percent) of seeded polio virus and bacteria through these processes alone; and subsequent to conventional biological secondary treatment, can produce effluent essentially free of measurable levels of bacterial and viral pathogens.

Nitrification

Nitrification is the biological conversion of ammonia nitrogen sequentially to nitrite nitrogen and nitrate nitrogen. Nitrification does not remove significant amounts of nitrogen from the effluent: it merely converts it to another form.

Denitrification

Denitrification removes nitrate nitrogen from the wastewater. As with ammonia removal, denitrification is usually done biologically for most municipal applications. In biological denitrification, nitrate nitrogen is used by a variety of heterotrophic bacteria as the terminal electron acceptor in the absence of dissolved oxygen (anaerobic conditions). In the process, nitrate nitrogen is converted to nitrogen gas, which escapes to the atmosphere. The bacteria in these processes require a carbonaceous food source (e.g., carbonaceous BOD, methanol).

Phosphorus Removal

Phosphorus can be removed from wastewater by either chemical or biological methods, or a combination of the two.

Carbon Adsorption

One of the most effective advanced wastewater treatment processes for removing biodegradable and refractory organic constituents is the use of granular activated carbon (GAC). GAC can reduce the levels of synthetic organic chemicals in wastewater by 75 to 85 percent. The basic mechanism of removal is by adsorption of the organic compounds onto the carbon. Carbon adsorption preceded by conventional secondary treatment and filtration can produce an effluent with a Biochemical

Oxygen Demand (BOD) of 0.1 to 5.0 mg/L, Chemical Oxygen Demand (COD) of 3 to 25 mg/L, and Total Organic Compound (TOC) of 1 to 6 mg/L.

Reverse Osmosis

Reverse Osmosis (RO) is used mainly as a wastewater treatment process to remove suspended and dissolved solids (including microorganisms), either organic or inorganic. Removal is accomplished by the passage of wastewater through a semi-permeable membrane. The size, shape, chemical characteristics, and concentration of the chemical species, as well as the physical and chemical characteristics of the feed wastewater and type of RO unit employed influence constituent removal. Because of the nature of the RO process, feed wastewater must be of a fairly high quality (low suspended solids content) to prevent membrane clogging and deterioration.

Emerging Hybrid Technology

Membrane bioreactor (MBR) is an emerging technology, which combines an activated sludge reactor with a membrane filtration unit. The end result is an effluent that is similar to the one that is produced by a process train consisting of a secondary treatment followed by tertiary treatment and advanced treatment. MBR process essentially eliminates the tertiary treatment step. The MBR effluent is considered suitable for aquifer recharge.

Disinfection

The most important process for the destruction of microorganisms is disinfection. Although the most common disinfectant is chlorine, ozone (O_3) and ultraviolet (UV) radiation are other prominent disinfectants used at wastewater treatment plants. Other disinfectants, such as gamma radiation, bromine, iodine, and hydrogen peroxide, have been considered for the disinfection of wastewater, but are not generally used because of economical, technical, operational, or disinfection efficiency considerations. Membrane processes (e.g., micro-filtration, ultrafiltration, and reverse osmosis) have been shown to be effective in removing microorganisms, including viruses, from municipal wastewater, but again are not commonly used. The strategy in the selection and use of disinfectants for source waters prior to recharge should recognize the possibility that the nature and quantities of the disinfection by-products (DBPs) that may be formed are different from those in conventional water treatment. For example, both chlorine and ozone react in wastewater with organic precursors, which are likely to be greater in number and concentration than in freshwater sources of drinking water, to form DBPs. Accordingly, treatment of water for potable purposes is being modified to minimize the use of oxidizing disinfectants. However, in the treatment of wastewater for non-potable purposes, the numbers and concentration of DBPs are of less concern because long-term ingestion is not an issue.

Chlorine

The efficiency of disinfection with chlorine depends on the water temperature, pH, degree of mixing, time of contact, presence of interfering substances, concentration and form of chlorinating species, and the nature and concentration of the organisms to be destroyed. In general, bacteria are less resistant to chlorine than viruses, which in turn are less resistant than parasite ova and cysts.

The chlorine dosage required to disinfect a wastewater to any desired level is greatly influenced by the constituents present in the wastewater. Secondary effluent can be disinfected with chlorine to achieve very low levels of coliform bacteria, although complete destruction of pathogenic bacteria and viruses is unlikely to occur. Chlorination of secondary effluent that has received further treatment to remove suspended matter can produce wastewater that is essentially free of bacteria and viruses. Chlorine, at the normal concentrations used in wastewater treatment, may not destroy helminth eggs, Giardia lamblia, and Crypto sporidium species.

Ozone

Ozone is a powerful disinfecting agent and a powerful chemical oxidant in both organic and inorganic reactions. Due to the instability of ozone, it must be generated on site from air or oxygen carrier gas. Ozone destroys bacteria and viruses by means of rapid oxidation of the protein mass, and disinfection is achieved in a matter of minutes. Some disadvantages are that the use of ozone is relatively expensive and energy intensive, ozone systems are more complex to operate and maintain than chlorine systems, and ozone does not maintain a residual in water. Ozone is a highly effective disinfectant for advanced wastewater treatment plant effluent, and it removes color and contributes dissolved oxygen. It also breaks down recalcitrant organic compounds into more biodegradable compounds, which is advantageous for ground water recharge and soil-aquifer treatment.

Ultraviolet Radiation

Irradiation of wastewater with ultraviolet radiation for disinfection is potentially a desirable alternative to chemical disinfection, owing to its inactivating power for bacteria and viruses, affordable cost, and the absence of chemical disinfection by-products. Exposure of microorganisms to the appropriate amount of electromagnetic (EM) radiation disrupts the cells' genetic material and interferes with the reproduction process. Some bacteria have repair enzyme systems that are activated by similar EM energies, and thus these particular bacteria may repopulate disinfected waters after disinfection when exposed to light. UV disinfection for water and wastewater is the newest of the disinfection technologies and therefore, valuable large-scale field applications are still under study. However, the trend is toward more use of UV disinfection.

4. Wastewater Recharge/Drinking Water Reuse Experience In The U.S.A.

General

There are approximately 1,900 wastewater reuse projects currently operating throughout the USA (approximately 34 states have such projects). Only a very small number (probably less than 10) of those projects use direct wastewater recharge into an aquifer. In most cases, the wastewater is used (after proper treatment) for irrigation of urban landscapes and agricultural land or industrial purposes.

Within the United States, wastewater reuse is most common in Florida, California and Arizona. Prominent projects of wastewater reuse for drinking water or ground water recharge are as follows:

Water Factory 21 in Orange County, California

The Orange County Water District (OCWD) has been injecting high quality reclaimed water into selected coastal aquifers to establish a saltwater intrusion barrier. Seawater intrusion was first observed in municipal wells during the 1930s as a consequence of basin overdraft. Over-drafting of the ground water continued into the 1950s. Over-pumping of the ground water resulted in seawater intrusion as far as 3.5 miles inland from the Pacific Ocean by the 1960s.

OCWD began pilot studies in 1965 to determine the feasibility of injecting effluent from an advanced wastewater treatment (AWT) facility into potable water supply aquifers. Construction of an AWT facility, known as Water Factory 21, began in 1972 in Fountain Valley, and injection of the treated municipal wastewater into the ground began in 1976.

Water Factory 21 accepts activated-sludge secondary effluent from the adjacent County Sanitation Districts of Orange County wastewater treatment facility. The 15 MGD water reclamation plant processes consist of: lime clarification for removal of suspended solids, heavy metals, and dissolved minerals; re-carbonation for pH control; mixed-media filtration for removal of suspended solids; activated carbon absorption for removal of dissolved organic compounds; reverse osmosis for demineralization and removal of other constituents; and chlorination for disinfection and algae control.

Prior to injection, the product water is blended 2:1 with deep well water from an aquifer not subject to contamination. The blended water is chlorinated in a blending reservoir before it is injected into the ground. Depending on conditions, the injected water flows toward the ocean, forming a seawater barrier; inland to augment the potable ground water supply; or in both directions. On average, well over 50 percent of the injected water flows inland. It is estimated that this injected water makes up no more than 5 percent of the water supply for area residents who rely on ground water.

County Sanitation Districts of Los Angeles County Ground Water Recharge Projects

Since 1962, the Whittier Narrows Water Reclamation Plant (WRP) has used reclaimed water along with surface water and storm water to recharge ground water in the Montebello Forebay area of Los Angeles County by surface spreading of the reclaimed water. The reclaimed water makes up a portion of the potable water supply for the area residents that rely on ground water. From 1962 until 1973, the Whittier Narrows WRP was the sole provider of reclaimed water in the form of disinfected secondary effluent for recharge. Some surplus effluent from a third treatment plant, the Pomona WRP, is released to the San Jose Wash, which ultimately flows to the San Gabriel River and becomes an incidental source for recharge in the Montebello Forebay.

The WRPs start their wastewater treatment with primary and secondary biological treatment. In 1978, all three WRPs added tertiary treatment with mono- or dual-media filtration and chlorination/dechlorination to their treatment regimes.

After leaving the reclamation plants, the reclaimed water is conveyed to one of several spreading areas (either specially prepared spreading grounds or dry river channels or washes). In the process of ground water recharge, the water percolated through an unsaturated zone of soil ranging in average thickness from about 10 to 40 feet before reaching the ground-water table. The usual spreading consists of five days of flooding, during which water is piped into the basins and maintained at a constant depth. The flow is then discontinued. The basins are then allowed to drain and dry out for 16 days. This wet and dry cycle maintains the proper conditions for the percolation process.

Denver's Direct Potable Water Reuse Demonstration Project

In 1968, the Environmental Protection Agency (EPA) allowed Denver to divert water from the Blue River on the west side of the Continental Divide on the condition that it examine a range of alternatives to satisfy projected future demands of a growing metropolitan area. The Direct Potable Water Reuse Demonstration Project was designed to examine the feasibility of converting secondary effluent from a wastewater treatment plant to water of potable quality that could be piped directly into the drinking water distribution system. In 1979, plans were developed for the construction of a demonstration facility to examine the cost and reliability of various treatment processes. The 1.0 MGD treatment plant began operation in 1985, and during the first three years, many processes were evaluated. Data from the evaluation period was used to select the optimum treatment sequence, which was used to produce samples for a two-year animal feeding health- effect study. Comprehensive analytical studies defined the product water quality in relation to existing standards and to Denver's current potable supply. The project water exceeded the quality of Denver's drinking water for all chemical, physical, and microbial parameters tested except for nitrogen, and alternative treatment options were demonstrated for nitrogen removal. The final health-effect study demonstrated no health effects associated with either water. The raw water supply for the reuse plant was unchlorinated secondary effluent (treated biologically) from the metropolitan Denver wastewater treatment facility. Advanced treatment included high-pH lime treatment, single- or two-stage re-carbonation, pressure filtration, selective ion exchange for ammonia removal, two-stage activated carbon adsorption, ozonation, reverse osmosis, air stripping, and chlorine dioxide disinfection. Side stream processes included a fluidized bed carbon reactivation furnace, vacuum sludge filtration, and selective ion exchange regenerant recovery.

San Diego's Total Resource Recovery Project

San Diego, California imports virtually all of its water supply from other parts of the state. New sources of imported water are not readily available; the availability of existing supplies is diminishing. The city is thus actively investigating advanced water treatment technologies for reclaiming municipal wastewater that is presently being discharged to the Pacific Ocean. Preliminary experiments were conducted at the bench-scale (20,000 gallons per day) Aqua I facility in Mission Valley from 1981 to 1986. The pilot-scale (300,000 gallons per day secondary, 50,000 gallons per day advanced) treatment Aqua II Total Resource Recovery facility operated at Mission Valley from 1984 through 1992. The full-scale demonstration Aqua III facility (1.0 MGD secondary, 500,000 gallons per day advanced) was constructed in Pasqual Valley and began full-time operation in October 1994.

The Aqua II pilot facility uses channels containing water hyacinths for secondary treatment followed by a 50,000 gal/day advanced treatment system designed to upgrade the secondary effluent water to a quality equivalent to raw water for potable reuse. A technical advisory committee in conjunction with the city selected the tertiary and advanced process trains in 1985. Tertiary treatment to produce a low-turbidity water suitable for reverse osmosis feedwater was provided by a package water treatment plant, with ferric chloride coagulation, flocculation, sedimentation, and multimedia filtration. The system included ultraviolet light disinfection, cartridge filtration, chemical pretreatment, reverse osmosis using thin-film composite membranes, aeration tower decarbonation, and carbon adsorption. The final process train produces water that meets U.S. drinking water standards.

Tampa Water Resource Recovery Project

The Tampa Water Resource Recovery Project was developed to satisfy the future water demands of both the City of Tampa and the West Coast Regional Water Supply Authority. The proposed project involves the supplemental treatment of the Hookers Point Advanced Wastewater Treatment (AWT) Facility effluent to achieve acceptable quality for augmentation of the Hillsborough River raw water supply. In 1993, a pilot plant was designed, constructed, and operated to evaluate supplemental treatment requirements, performance, reliability, and quality.

Source water for the pilot plant was withdrawn downstream from AWT Facility denitrification filters prior to chlorination. The pilot plant facility evaluated four unit process trains, all of which included preaeration, lime treatment and recarbonation, and gravity filtration, followed by either (1) ozone disinfection, (2) reverse osmosis and ozone disinfection, (3) ultrafiltration and ozone disinfection, or (4) granular activated carbon (GAC) adsorption and ozone disinfection. The process train including GAC adsorption and ozone disinfection was selected for design.

The City of Tampa’s industrial base is mostly food oriented. Inputs to the wastewater system were confirmed by a “vulnerability analysis.” Tampa has an active pretreatment program, and there has been no interference with the plant’s biological process since startup in 1978.

The design of the advanced treatment plant allows for rejection of water at any level of treatment and diversion back to the main plant. The use of a bypass canal for storage and mixing provides a large storage capacity and constant dilution of product water with canal and river water. Water can be diluted from the aquifer when river water is not available. Flood control gates allow the canal to be flushed if a problem is detected. Canal water can be drawn through a "linear well field" along the canal to provide further ground water dilution. Five miles of canal and river provide additional natural treatment prior to the intake for the drinking water treatment plant.

Public Health Issues of Wastewater Effluent Recharge

The following material is derived from the information provided in the National Research Council's Report on Ground Water Recharge Using Waters of Impaired Quality (1994).

A major consideration in the use of wastewater effluent for artificial recharge is the possible presence of chemicals in the effluent that may be hazardous to human health. At the present time, according to the National Research Councils Committee Report on Ground Water Recharge Using Waters of Impaired Quality, on the basis of available information, there is no indication that the health risks from using reclaimed wastewater are greater than those from using existing water supplies or that the concentrations of chemicals, with several exceptions, or microorganisms are higher than those established in drinking water standards set by the EPA.

Studies have been made of the chemical and microbiological characteristics of recovered water, although they are limited in number and scope. Several studies have shown that the recovered water can meet drinking water standards, even when the recharge source is treated municipal wastewater. Such findings lead some experts to the conclusion that these extracted waters are as acceptable as water supplied from traditional sources. Other experts strongly disagree; saying that water originating from an impaired source is inherently more risky. For instance, disinfection of the recharge waters may develop a different mix of disinfection by-products (DPBs), often unidentified, from those found in conventional water supplies. Also, the characterizations of the organic material and the full range of microbiological constituents are incomplete. In addition, source waters of impaired quality and recharge water withdrawn from the aquifer at the point of use may contain some contaminants at higher concentrations than are likely to be present in conventional water supplies. And throughout the whole process, there is increased reliance on technology and management, leaving open the door for errors. Thus, the question arises whether drinking water standards developed for conventional water supply systems are sufficiently protective of human health when ground water is recharged with waters of impaired quality. There is a substantial amount of uncertainty principally related to the presence of synthetic organic chemicals, inorganic chemicals, disinfection by-products, and pathogenic organisms.

The assessment of health risks associated with recharge using wastewater effluent is far from definitive because there are limited chemical and toxicological data and inherent limitations in the available toxicological and epidemiological methods. The limited data and extrapolation methodologies used in toxicological assessments provide a source of limitations and uncertainties in the overall risk characterization.

Similarly, epidemiological studies suffer from the need for very long time periods required, because cancers have latency periods of 15 year or more. Also, such studies require large populations to uncover the generally low risks associated with low concentrations of toxicants. Past studies of the possible adverse health effects from reclaimed water have tended to be limited in terms of toxicological characterization and have focused only on those chemicals for which drinking water standards exist.

Summary and Conclusions

Many communities currently use water sources of varying quality, including sources that receive significant upstream discharges of wastewater. In this sense, cities upstream of drinking water intakes are already providing water reclamation in their wastewater treatment facilities; for they treat the water, then release it into the raw water supply used by downstream communities.

A small but growing number of communities include the use of highly treated wastewater to augment water supply. Projects currently operating in the United States generally produce reclaimed water that meets or exceeds the quality of the raw waters those systems would use otherwise, as measured by current standards established by the Safe Drinking Water Act. Current potable reuse projects and studies have demonstrated that technology exists to produce reclaimed water of excellent measurable quality and to ensure system reliability.

Assessment of health risks associated with recharge using wastewater effluent is far from definitive because there are limited chemical and toxicological data and inherent limitations in the available toxicological and epidemiological methods.

E. STORMWATER MANAGEMENT AND GROUNDWATER RECHARGE INITIATIVES

The implementation of infiltration measures as part of stormwater management will increase the annual recharge to groundwater. One method of improving the groundwater infiltration may be creating improvements to developed subdivisions were stormwater management was never applied. Some of the recharge potential in these subdivisions could be restored by retrofitting the existing drainage systems to encourage infiltration. The incorporation of infiltration trenches and basins, dry wells and water quality swales are some of the measures that could be utilized. This stormwater management initiative would be a large undertaking and potentially expensive to accomplish.

The Town began addressing its drainage and stormwater in 1999 with a project consisting of an evaluation and mapping of limited areas of wastewater and drainage infrastructure on Island. There have been numerous amendments to the original contract, adding additional phases and the complete wastewater infrastructure area to the project.

Extensive inspections have been performed on approximately 3,300 wastewater and drainage manholes, drainage catch basins and drainage out-flow structures in Town. Since 1999, additional work has been done not only inspections but also topographical surveys, GIS mapping, and database developing for the Town. The most recent work completed provides the Town with detailed horizontal and, more importantly, vertical elevations of the entire wastewater and drainage infrastructures and an evaluation of the 14 outfalls that discharge into Nantucket Harbor. Work to be completed includes individual catch basin watershed analysis and pipe system analysis.

F. SHORT LIST OF ALTERNATIVES

1. General

The CWMP/EIR Phase I and Phase II Documents identified a variety of alternative wastewater disposal options to be evaluated for each area of wastewater disposal need. These alternatives, which include: (1) the continued use of existing on-site wastewater disposal systems; (2) replacement of existing wastewater disposal systems with Title 5 systems; (3) replacement of existing wastewater disposal systems with on-site innovative/alternative (I/A) systems; (4) replacement of existing wastewater disposal systems with cluster systems consisting of a pressure system and communal subsurface disposal; (5) replacement of the existing wastewater disposal system with a conventional sewer collection system by, either: (a) connection into the existing collection system at Surfside or Siasconset, (b) gravity sewers and pump station(s), (c) pressure sewers and grinder pumps, or (d) a combination thereof.

Section 4.0 of this Document evaluates the costs associated with each of the short-listed alternatives and plan selection and Section 5.0 of this Document details the final recommended plan.

The CWMP/EIR Phase I Document determined study areas where conventional Title 5 wastewater disposal systems are inadequate for long-term sustainability and study areas where existing on-site systems can remain and be effective for wastewater disposal. The Phase II Document evaluated the alternatives listed above for each of the identified Need Areas. The alternatives that were further evaluated for each of the areas of wastewater disposal need are shown in Table 2-23.

TABLE 2-23
TOWN OF NANTUCKET
CWMP/FEIR
ALTERNATIVE SUMMARY

Study Area	On-Site	I/A	Communal	Local
1-Madaket			**X**	**X**
2-Warren's Landing			**X**	**X**
3-Cisco	X			
4-Somerset			**X**	**X**
5-Miacomet	X			
6-Surfside				
7-Tom Nevers Low Density	X			
7H-Tom Nevers High Density	X			
8-Siasconset				**X**
9-Quidnet	**X**	**X**	**X**	**X**
10-Wauwinet	**X**	**X**	**X**	**X**
11-Pocomo	**X**	**X**	**X**	**X**
12-Polpis	**X**	**X**	**X**	**X**
13-Town				**X**
14-Town-WPZ				**X**
15-Shimmo			**X**	**X**
16-Monomoy			**X**	**X**
17-Remainder of Island	X			

Note: Bold text indicates Study Area is a "Need Area"

The continued use of existing on-site disposal systems was evaluated for all Study Areas on Island. This evaluation was based on existing on-site systems and with replacement Title 5 systems. Local wastewater treatment and disposal systems were evaluated for all areas of need since this is a viable alternative. Communal wastewater treatment and disposal systems was evaluated only for those areas of need in which there is a site or sites available for treated wastewater effluent disposal within that specific Study Area. Innovative Alternative wastewater treatment and disposal systems were evaluated for those areas of need, which meet the severe soil limitations and high groundwater criteria necessary for proper operation and maintenance.

An analytical approach was utilized to assess the viability of each alternative for each of the individual Study Areas. The alternatives were evaluated based on technical considerations, environmental benefits, and economic feasibility. A screening process was used, which rejected options that do not meet the physical constraints of the planning area, such as climate, soils, and topography. Options were rejected if they were not compatible with air and water quality. Only options that which appear to provide the greatest environmental, technical, financial and institutional benefits have been short-listed. Other factors used in the screening process include reliability, complexity, ease of implementation as well as capital and operating costs.

2. Technical Considerations

On-Site Wastewater Disposal

On-site wastewater disposal was evaluated based on the ability of existing systems to perform to current Title 5 standards. This includes optimizing Septage Management Plans, maintenance and repair and upgrade of on-site systems.

Innovative/Alternative Wastewater Treatment and Disposal Systems

I/A treatment was evaluated based on the ability of the process to perform under existing conditions. The review consists of answering "Yes" or "No" to the following three questions: (1) Is a majority of the lot sizes within the Study Area greater than one-third acre; (2) Do suitable soils exist for more than 70 percent of the Study Area?; and (3) Do suitable groundwater conditions exist for more than 80 percent of the Study Area?

Is a majority of the lot sizes within the Study Area greater than one-third acre?

Lot size has a direct effect on whether or not a failed on-site wastewater disposal system can be repaired to meet Title 5 criteria with the use of I/A technologies. It is assumed that under ideal soil and groundwater conditions, all lots of one-third acre or less with an on-site wastewater disposal system would, as a minimum, require a variance to Title 5 in order to be repaired. A one-third acre lot size is the absolute minimum lot size, which is feasible for an upgrade of an existing on-site wastewater disposal system.

Another contributing factor utilized in the screening process were the results of the effect of the water balance in each of the 14 drainage sub-basins on the Island, which is included in this section.

Based on all these factors, a short list of alternatives has been developed to meet Nantucket's long-term wastewater needs. Refer to Table 2-23 for the short-list of alternatives.

Do suitable soils exist for more than 70 percent of the study area?

If 30 percent or less of the soils within a study area were classified as having severe limitations (hardpan, bedrock, slope, flooding and wetness) the severe soils criteria has been met. Soil types were obtained from the Nantucket County Soil Survey Report by the U.S. Department of Agriculture.

If the question is answered "Yes", then I/A treatment is considered a feasible alternative for existing areas of wastewater disposal need. If the question is answered "No", then the evaluation would continue and the next question which must be answered "Yes" in order for I/A treatment to be considered a feasible alternative for existing areas of wastewater disposal need.

Do suitable groundwater conditions exist for more than 80 percent of the study area?

If 20 percent or less of a study area is classified as having a moderately shallow to shallow (high water table at the surface to 2 feet deep) seasonally high groundwater level, the severe groundwater criterion has been met. The U.S. Department of Agriculture obtained high groundwater levels from the Nantucket County Soil Survey Report.

If the question is answered "Yes", then I/A technologies are considered a feasible alternative for existing areas of wastewater disposal need. If the question is answered "No" and the previous question was answered "No" then I/A technologies are not considered a feasible alternative for existing areas of wastewater disposal need.

If it is determined that the alternative is technically feasible then the alternative will be reviewed for environmental benefits and economic considerations.

Local Wastewater Collection, Transmission, Treatment and Disposal System

The local wastewater collection, transmission, treatment and disposal system alternative was evaluated based on the availability of site(s) for wastewater treatment facilities and treated wastewater effluent disposal sites located within the Town of Nantucket. The evaluation consists of answering "Yes" or "No" to the following four questions: (1) Is there available capacity in either the Siasconset Wastewater Treatment Facility or the Surfside Wastewater Treatment Facility for additional flows from Needs Areas; (2) If capacity is available, is it technically, economically and/or politically feasible to direct flow to either of these WWTFs; (3) If necessary, are sites available for the construction of wastewater treatment facilities?; and (4) Are sites available for treated wastewater effluent disposal via groundwater discharge?. All questions must be answered "Yes" in order for local wastewater collection, transmission, treatment and disposal system alternative to be considered a feasible alternative for two or more designated areas of wastewater disposal need.

If it is determined that this alternative is technically feasible then this alternative will be reviewed for environmental benefits and economic considerations.

Communal Wastewater Collection, Transmission, Treatment and Disposal System

The communal wastewater collection, transmission, treatment and disposal system alternative was evaluated based on the availability of site(s) for a wastewater treatment facilities and treated wastewater effluent disposal sites located within a given area of need. The evaluation consists of answering "Yes" or "No" to the following two questions: (1) Is a site available for construction of a wastewater treatment facility?; and (2) Is a site available for treated wastewater effluent disposal via groundwater discharge?. Both questions must be answered "Yes" in order for the communal wastewater collection, transmission, treatment and disposal system alternative to be considered a feasible alternative for a designated area of wastewater disposal need.

If it is determined that this alternative is technically feasible then this alternative will be reviewed for environmental benefits and economic considerations.

3. Environmental Benefits

Each technically feasible alternative was further evaluated for its ability to meet the following environmental goals: maintain stream flows, recharge Zone II aquifers, and reduce pollutant loadings to preserve aquatic habitats. The evaluation consisted of answering "Yes" or "No" to the following three questions: (1) Does the alternative maintain stream flows?, (2) Does the alternative recharge a Zone II aquifer area?, and (3) Does the alternative reduce pollutant loadings?.

Does the alternative maintain stream flows?

This question would be answered "Yes" if the treated wastewater effluent from the alternative discharges into a location that would maintain stream flows within the Town of Nantucket. A "Yes" answer would be indicative of an environmental benefit. This question would be answered "No" if the effluent from the alternative discharges into a location that would not maintain stream flows within the Town of Nantucket. A "No" answer would indicate that the alternative has no environmental benefit in maintaining stream flows.

Does the alternative recharge a Zone II aquifer area?

This question would be answered "Yes" if the treated wastewater effluent from the alternative discharges into a Zone II aquifer, and therefore results in an environmental benefit. Likewise, this question would be answered "No" if the treated wastewater effluent from the alternative does not discharge into a Zone II aquifer area and therefore would not result in an environmental benefit as recharge.

Does the alternative reduce pollutant loadings?

This question would be answered "Yes" if the treated wastewater effluent from the alternative reduces pollutant loadings to a higher degree than a conventional Title 5 system. Since all of the alternatives being considered will reduce pollutant loadings to a higher degree than a conventional Title 5 system, this question will be answered "Yes" for all of the alternatives. Therefore, all of the alternatives will reduce pollutant loadings and are environmentally beneficial.

4. Economic Considerations

All technically feasible and environmentally beneficial alternatives were further evaluated with regard to estimated project costs and estimated annual operation and maintenance costs. The estimated project costs include costs for construction, engineering services, fiscal, legal, administrative, land acquisitions, easements and police details. The estimated operation and maintenance costs were converted to a present worth value based on the interest rate of 7 percent and the expected life cycle of the alternative. Capital construction and operation and maintenance costs were computed for each feasible alternative by designated area of need. The total present worth value (capital construction and operation and maintenance) for each feasible alternative was divided by the number of users serviced in order to normalize the costs on a per user basis.

5. Water Balance Impacts

Water balance can be described as replacing whatever groundwater is removed via potable sources and the elimination of groundwater recharge through the use of on-site wastewater disposal systems with groundwater recharge by means of treated effluent discharge into the ground.

Maintenance of water balance within the drainage sub-basins was a consideration in the evaluation of alternatives. The cause and effects of alternative wastewater treatment on the water balance in each sub-basin was reviewed for impacts. Efforts to recharge the groundwater in any need areas whose water balance has been affected by alternative wastewater treatment and disposal takes precedence. Every attempt was made to be able to locate disposal of highly treated effluent within sub-basins experiencing or proposed to experience stress due to the removal of on-site wastewater system recharge. This was not always possible due to a number of environmental factors that far outweighed any recharge benefits. Many of the Study Areas have been identified as a “Need Area” due to the “severe” soil and groundwater conditions, which would preclude the discharge of larger quantities of treated effluent. Section 4.0 of this Document details the alternatives reviewed for each need area and the effect, if any, on the water balance in the drainage sub-basin. The Report, “Nantucket Water Resources Management Plan”, completed by Horsely and Witten in May 1980, states that “it is the precipitation that falls onto the Island’s sandy permeable soils, upwards of 30 billion gallons per year, that actually recharge the underground aquifer”. While this CWMP/EIR evaluation looked at the more finite goal of recharging individual sub-basins with the location of effluent discharge, the overall goal of recharging the major basin will be accomplished. Refer to Table 2-24 through Table 2-28 for the Island-wide effects on the water balance.

Background

The Commonwealth of Massachusetts Watershed Initiative is a collaborative effort of state and federal agencies, conservation organizations, municipal officials and other interested parties working towards protecting and restoring natural resources and ecosystems on a watershed basis. Because watersheds are defined by natural hydrology, they represent the most logical basis for managing water resources. The primary goals of the Watershed Initiative are to:

- Improve water quality;
- Restore natural flows to rivers;
- Protect and restore sensitive habitats;
- Improve public access and balance resource use;
- Improve local abilities to protect water resources; and
- Promote shared responsibility for watershed protection and management.

A significant change in the Commonwealth's approach to managing the state's water resources occurred in 1993 with the adoption of the Watershed Initiative, a strategy to implement integrated, watershed-based resource management by establishing collaborative efforts among individuals, groups, municipalities and agencies with local, regional, state and federal agencies in each watershed. The watershed is the primary focus for coordinating and resolving resource management issues such as water supply shortages, stream flows, fisheries and wildlife protection and wastewater assimilation.

The 1996 update of the Massachusetts Water Supply Policy Statement recommends that action be coordinated with the watershed approach to strengthen local capability to develop and implement water resource management programs. In addition, the 1996 statement advocates that: (1) communities recognize the interconnection of groundwaters and surface waters in water supply management and planning; (2) local and regional integration of planning and management of water supplies and wastewater treatment; (3) aggressive implementation of water conservation measures; (4) watershed protection to ensure both ground and surface water quality are protected and improved; (5) reduce the need for out of basin resources ("keep it local"); and (6) the updating of local zoning bylaws to protect and preserve the natural resources capacity while seeking to provide adequate water supply and wastewater treatment.

TABLE 2-24
TOWN OF NANTUCKET
CWMP/FEIR
WATER WITHDRAWALS

Name	Subbasin	Registered Volume (MGD)[1]	Permitted Volume (MGD)[1]	Days[2]	Actual Pumpage [1] 2001 (MGD)	Volume Distributed 2001[3] (MGD)	Summer Useage 2001[4] (MGD)	Volume Distributed Summer 2001 (MGD)	Estimated Useage 2025[5] (MGD)	Volume Distributed 2025 (MGD)	Estimated Summer Useage 2025 [4,5] (MGD)	Volume Distributed Summer 2025 (MGD)	Over Usage Volume[6] (MGD)
Wannacomet Water Company (3 Wells)		0.610	0.62	365									0.71
	Harbor				0.125	0.13	0.44	0.44	0.20	0.20	0.71	0.71	0.00
	Harbor				0.674	0.67	0.85	0.85	1.08	1.08	1.36	1.36	0.00
	Ocean				0.458	0.46	1.05	1.05	0.74	0.74	1.69	1.69	0.00
Siasconset Water Department (4 wells)		0.110	0.00	365									0.21
	Ocean				0.030	0.03	0.05	0.05	0.05	0.05	0.08	0.08	0.00
	Ocean				0.030	0.03	0.05	0.05	0.05	0.05	0.08	0.08	0.00
	Ocean				0.000	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Ocean				0.140	0.14	0.33	0.33	0.22	0.22	0.52	0.52	0.00
Miacomet Golf Course	Miacomet	0	0.146	210	0.000	0.00	0.00	0.00	0.146	0.00	0.248	0.00	0.00
Wauwinet House	Harbor	N/A	N/A	N/A	0.002	0.00	0.013	0	0.002	0	0.013	0	0.00
Surfside Beach	Ocean	N/A	N/A	N/A	0.000	0.0000	0.00	0	0	0	0	0	0.00
Westender Restaurant	Madaket	N/A	N/A	N/A	0.0004	0.0004	0.0011	0	0.0004	0	0.0011	0	
Nantucket Golf Club	Ocean	0	0.19	240	0.1047	0.09	0.18	0	0.19	0	0.32	0	0.00
Nantucket Conservation Foundation	Ocean	2.420	0	365	1.8800	0.94	1.8800	0.94	0	0	0	0	2.52
Ocean View Farm	Long	0.420	0	150	0.0800	0.04	0.16	0.08	0.42	0.21	0.84	0.42	0.46
Sankaty Head Golf Course	Ocean	0.130	0	183	0.1400	0.00	0.24	0	0.13	0	0.22	0	0.18
TOTAL		3.690	0.956		3.664	2.526	5.243	3.794	3.230	2.552	6.103	4.879	4.081

Notes:
1. Listing from DEP printout entitled "Actual Water Use – 2001". DEP lists withdrawals over the permitted period. Actual Usage numbers were adjusted for the whole year.
2. Days reflect approved number of days of operation.
3. Volume distributed reflects the volume of water, which flows to surface water or groundwater. Agricultural lands are calculated to have a 50% consumption rate and a 50% recharge rate. Golf courses, commercial, and industrial withdrawal are calculated to have a 100% loss. Industrial losses are assumed to be 100% since they discharge to the municipal WWTF and are included in the municipal collection calculations.
4. Summer usage assumes that the days of operation include July and August.
5. Estimated Usage is the registered or permitted withdrawal amount adjusted for the whole year.
6. Water Withdrawal Registrations issued before the Water Management Act include a clause which allows the Withdrawal Volume to exceed the Registered Volume by 100,000 gallons per day of operation. In subsequent tables, future water withdrawals are based on maximum permitted amount. Over usage volumes are shown here to illustrate a possible worst case scenario.

TABLE 2-25
TOWN OF NANTUCKET
CWMP/FEIR
WATER BALANCE IMPACTS - 2001 ANNUAL

Subbasin	(-) Amount Withdrawn (mgd)	(-) Amount Distributed (mgd)	(-) Amount Collected (mgd)	(+) Amount Discharged (mgd)	Water Balance Impact (mgd)	Groundwater Recharge (mgd)
Capaum	0.00	0.00	0.00	0.00	0.00	0.00
Harbor	0.80	0.57	0.77	0.00	-1.01	-0.21
Hummock	0.00	0.06	0.09	0.00	-0.02	-0.02
Long	0.08	0.04	0.00	0.00	-0.04	0.04
Madaket	0.00	0.00	0.00	0.00	0.00	0.00
Maxcy	0.00	0.00	0.00	0.00	0.00	0.00
Miacomet	0.00	0.21	0.29	0.00	-0.08	-0.08
Ocean	2.78	1.50	0.65	1.80	-0.13	0.86
Sesachacha	0.00	0.00	0.00	0.00	0.00	0.00
Tom Nevers	0.00	0.00	0.00	0.00	0.00	0.00
Washing	0.00	0.00	0.00	0.00	0.00	0.00
Total	**3.66**	**2.386**	**1.80**	**1.80**	**-1.28**	**0.59**

TABLE 2-26
TOWN OF NANTUCKET
CWMP/FEIR
WATER BALANCE IMPACTS - 2001 SUMMER

Subbasin	(-) Amount Withdrawn (mgd)	(-) Amount Distributed (mgd)	(-) Amount Collected (mgd)	(+) Amount Discharged (mgd)	Water Balance Impact (mgd)	Groundwater Recharge (mgd)
Capaum	0.00	0.00	0.00	0.00	0.00	0.00
Harbor	1.30	1.05	1.06	0.00	-1.32	-0.01
Hummock	0.00	0.12	0.12	0.00	0.00	0.00
Long	0.16	0.08	0.00	0.00	-0.08	0.08
Madaket	0.00	0.00	0.00	0.00	0.00	0.00
Maxcy	0.00	0.00	0.00	0.00	0.00	0.00
Miacomet	0.00	0.40	0.40	0.00	0.00	0.00
Ocean	3.78	1.82	0.89	2.47	-0.38	0.93
Sesachacha	0.00	0.00	0.00	0.00	0.00	0.00
Tom Nevers	0.00	0.00	0.00	0.00	0.00	0.00
Washing	0.00	0.00	0.00	0.00	0.00	0.00
Total	**5.24**	**3.468**	**2.47**	**2.47**	**-1.78**	**0.99**

TABLE 2-27
TOWN OF NANTUCKET
CWMP/FEIR
WATER BALANCE IMPACTS - 2025 ANNUAL

Subbasin	(-) Amount Withdrawn (mgd)	(-) Amount Distributed (mgd)	(-) Amount Collected (mgd)	(+) Amount Discharged (mgd)	Water Balance Impact (mgd)	Groundwater Recharge (mgd)
Capaum	0.00	0.000	0.00	0.00	0.00	0.00
Harbor	1.29	1.051	1.15	0.00	-1.39	-0.10
Hummock	0.00	0.120	0.09	0.00	0.03	0.03
Long	0.42	0.000	0.10	0.00	-0.52	-0.10
Madaket	0.00	0.000	0.11	0.00	-0.11	-0.11
Maxcy	0.00	0.000	0.00	0.00	0.00	0.00
Miacomet	0.15	0.397	0.33	0.00	-0.08	0.07
Ocean	1.38	0.879	0.91	2.71	1.30	-0.03
Sesachacha	0.00	0.000	0.01	0.00	-0.01	-0.01
Tom Nevers	0.00	0.000	0.00	0.00	0.00	0.00
Washing	0.00	0.000	0.00	0.00	0.00	0.00
Total	**3.23**	**2.448**	**2.71**	**2.71**	**-0.78**	**-0.26**

TABLE 2-28
TOWN OF NANTUCKET
CWMP/FEIR
WATER BALANCE IMPACTS - 2025 SUMMER

Subbasin	(-) Amount Withdrawn (mgd)	(-) Amount Distributed (mgd)	(-) Amount Collected (mgd)	(+) Amount Discharged (mgd)	Water Balance Impact (mgd)	Groundwater Recharge (mgd)
Capaum	0.00	0.00	0.00	0.00	0.00	0.00
Harbor	2.09	1.85	1.58	0.00	-1.82	0.27
Hummock	0.00	0.15	0.13	0.00	0.02	0.02
Long	0.84	0.59	0.14	0.00	-0.40	0.44
Madaket	0.00	0.18	0.15	0.00	0.02	0.03
Maxcy	0.00	0.00	0.00	0.00	0.00	0.00
Miacomet	0.25	0.53	0.46	0.00	-0.17	0.08
Ocean	2.93	1.46	1.25	3.72	1.01	0.21
Sesachacha	0.00	0.01	0.01	0.00	0.00	0.00
Tom Nevers	0.00	0.00	0.00	0.00	0.00	0.00
Washing	0.00	0.00	0.00	0.00	0.00	0.00
Total	**6.10**	**4.769**	**3.72**	**3.72**	**-1.34**	**1.05**

It is these principles that form the foundation of the Commonwealth of Massachusetts Watershed Initiative, which support the "watershed approach" to environmental planning and decision making in order to guarantee the citizens and inhabitants of the Commonwealth sufficient quantity and quality of water resources for the long-term.

An initiative of this CWMP/EIR is to evaluate the potential positive effects of the disposal of highly treated wastewater effluent, as groundwater recharge, within the various watershed subbasins on Nantucket, in offsetting groundwater withdrawals as water supply and/or the replacement of on-site wastewater disposal facilities with sewers. The primary focus of the evaluation centers on areas of Town that are currently sewered or are a designated "Needs Area" where there is a potential for sewers. The result of the water balance analysis is a definitive identification of the watershed subbasins where the volume of groundwater removed as water supply is greater than, equal to or less than the volume of groundwater recharge through wastewater disposal. Potential discharge sites for the disposal of highly treated wastewater effluent will be given a priority within stressed watershed subbasins. Again, while this evaluation looked at the more finite goal of recharging individual sub-basins, the overall goal of recharging the major basin will be accomplished through the final recommended plan and as previously stated, it is the precipitation that falls onto the Island's sandy permeable soils, upwards of 30 billion gallons per year, that actually recharge the underground aquifer. While it is the precipitation that recharges the aquifer, the on-site wastewater systems currently utilized in Nantucket add to the recharge. The Water Balance completed as part of this Document, is an exercise that will identify those areas that will experience a groundwater recharge deficit due only to the removal of on-site wastewater disposal systems. These areas will still continue to receive the major benefits of aquifer recharge through annual precipitation. The watershed subbasins and Study Areas where sewers exist or may exist in the future are shown on Figure 2-12.

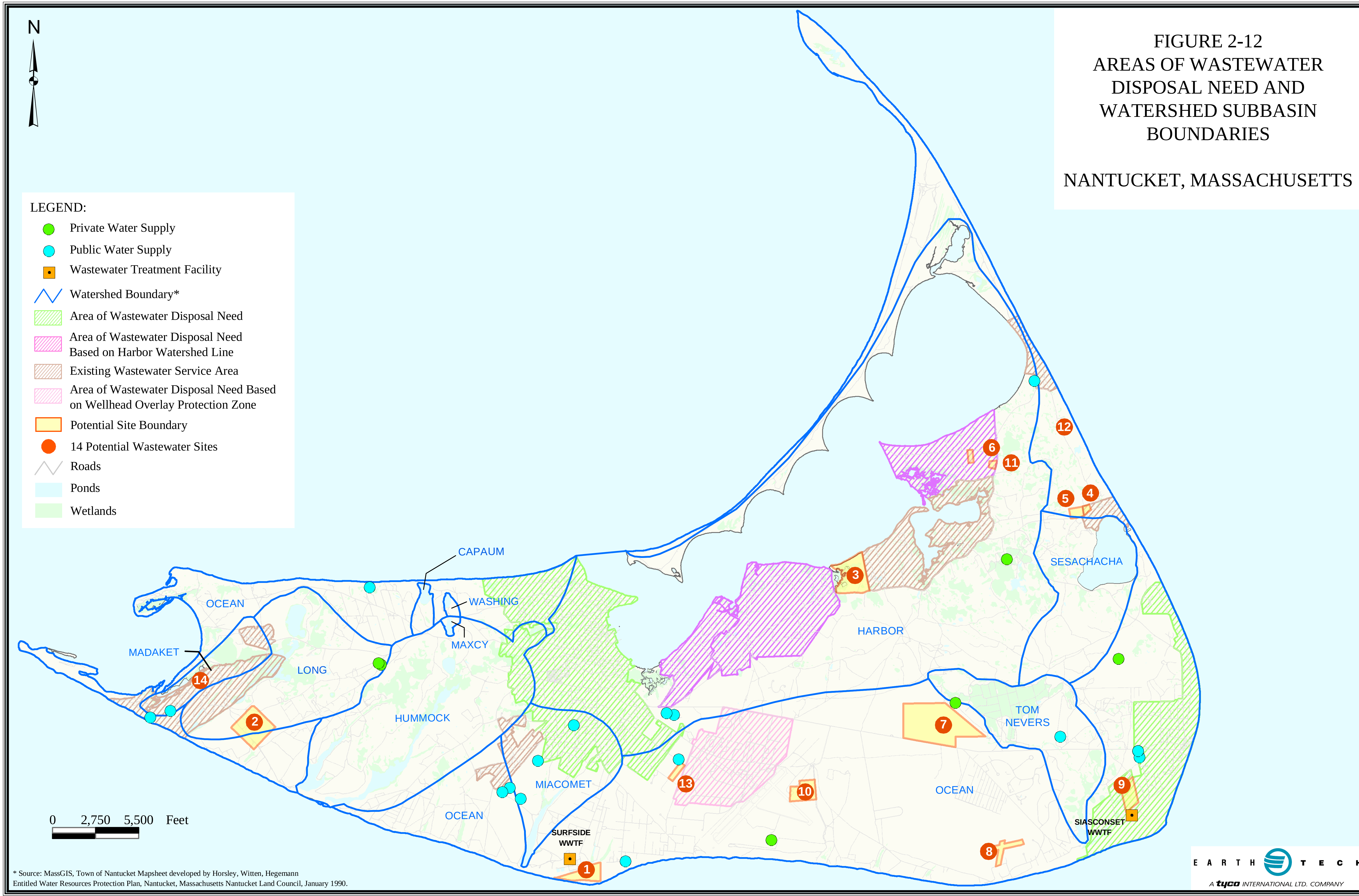


FIGURE 2-12
AREAS OF WASTEWATER DISPOSAL NEED AND WATERSHED SUBBASIN BOUNDARIES

NANTUCKET, MASSACHUSETTS

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SEPTEMBER 2003

The water balance is calculated by sub basin. The sub basins are delineated by Horsely, Witen, Hegemann Entitled Water Resources Protection Plan, Nantucket Massachusetts, Nantucket Land Counsel, January 1990.

The water balance is calculated using the following formula:

Water Balance = **(–)** Amount withdrawn **(+)** Amount distributed
(–) Amount collected

The groundwater recharge is calculated by the following formula:

Groundwater Recharge = **(+)** Amount distributed **(–)** Amount collected

Amount Withdrawn

The total amount of water withdrawn from each subbasin is the sum of the water withdrawn from the municipal water supply sources and all non-municipal water withdrawals by commercial/industrial entities that are required to report such data to the DEP. The municipal withdrawal volume data is from the Department of Environmental Protection's *2001 Public Water Supply Annual Statistical Report.* The non-municipal withdrawal volume data is from the DEP's *2001 Actual Water Withdrawal Report*. Additional water withdrawals from small capacity private wells that may be located within certain watersheds are assumed to be negligible.

The actual municipal withdrawal volumes, non-municipal withdrawal volumes and the DEP registered and/or permitted withdrawal volumes for the year 2001 along with the projected 2025 volumes of withdrawal from these sources are shown in Table 2-24. Each registered and/or permitted water supply source was placed in its respective subbasin based on its longitude and latitude and confirmed with the data included in the DEP Water Management Act permit for each source.

The summer withdrawals for 2001 and estimated summer withdrawals for 2025 are shown in Table 2-24. The summer withdrawals for 2001 are the average of the water withdrawals on the Island for the months of July and August. The non-municipal withdrawals for 2001 are the actual withdrawals from DEP and assume that the days of operation include the moths of July and August. The 2025 summer non municipal withdrawals are the maximum permitted amount and assume that the days of operation include the months of July and August.

The projected water withdrawal from existing municipal water supply sources in 2025 is based on the analysis performed for the Comprehensive Wastewater Management Plan. It is projected that the average daily withdrawal volume will increase by approximately 2 percent each year from 2002 to 2025. It is assumed in this analysis that the increase in withdrawal volume will be shared equally by all existing water supply sources and that no new water supply sources will be developed before 2025. The estimate of 2025 non-municipal withdrawals is assumed to be the maximum permitted amount.

Amount Distributed

The amount distributed is the volume of water dispersed throughout the entire water system. The amount distributed is calculated by using the water use quantities for the entire Island. The Island withdrawal quantities are then distributed across the area of water service in each sub basin.

The current amount of municipal water distributed in Nantucket was reported to DEP in the 2001 Public Water Supply Annual Statistical Report. The amount of water distributed over each subbasin is estimated from the recorded volume of water reported to DEP, as metered, to each category of municipal water customer. The difference between the volume of water delivered through the municipal water system infrastructure and the amount of water withdrawn at each supply source is unaccounted-for-water. The unaccounted-for-water component is distributed proportionally across the entire area of Town serviced by the municipal water system. Non-municipal withdrawals are added to the amount distributed in their respective subbasins. The water balance assumes that agricultural resources recharge the sub basins by 50 percent of their irrigation rate.[1]

Amount Collected

The amount of water collected is calculated by using the estimated quantity of wastewater delivered to the municipal sewer system. The amount collected the calculated quantity of wastewater pumped accepted at the Surfside WWTF in 2001 and the estimated amount of wastewater accepted at Surfside WWTF in 2025. The total collections are then distributed over the sewered area of the sub basins.

[1] Viessmaen, Jr., Warren, Hammer, Mark J., Water Supply and Pollution Control, Fifth Edition, HarperCollins College Publishers, 1993, pg. 32.

The annual total uses the discharge quantity from 2001, and the summer total uses the average 2001 discharge quantity for the months of July and August. This data is taken from the Phase I report. The 2025 total annual discharge assumes that the wastewater treatment plants discharge the estimated flow for the design year as calculated in the Phase I Report. The 2025 summer discharge is proportional to 2001 summer discharge. The 2025 collection area includes the Needs Areas.

Summary

The baseline water balance impact analysis for the calendar year 2001 is presented in Table 2-25 and Table 2-26. The result of this analysis shows that water withdrawals exceed groundwater recharge in 5 of the 11 subbasins located within the Nantucket. These subbasins and the effective negative recharge are summarized as follows: (a) Harbor; (b) Ocean; (c) Miacomet; (d) Long; and (e) Hummock.

The major cause of negative recharge in these subbasins is the municipal water supply. The Town's existing groundwater supply sources are located within the subbasins with the most impact, Harbor and Ocean. The effect of collecting potential recharge through the existing sewer system is minimal with respect to the withdrawal of groundwater supply from the municipal water supply system.

The projected water balance impact analysis for the calendar year 2025 is presented in Table 2-27 and Table 2-28. The result of this analysis shows that water withdrawals continue to exceed groundwater recharge in 5 of the 11 subbasins identified. Some of the subbasins have changed due to proposed water withdrawal changes. The projected effective negative recharge by subbasin for the calendar year 2025 are summarized as follows: (a) Harbor; (b) Long; (c) Madaket; (d) Miacomet; (e) Sesachacha.

If it is assumed that the recommended Town-wide wastewater management plan will include sewering as a long-term solution for wastewater disposal in the identified Needs Areas, then the amount of potential recharge from on-site wastewater disposal systems will be reduced accordingly. As is the case presently, the effect of collecting potential recharge through a proposed sewer system for the identified Needs Areas is minimal with respect to the withdrawal of groundwater supply from the municipal water supply system.

The primary goal of the Commonwealth of Massachusetts Watershed Initiative is to keep water local thereby maintaining more constant stream flows and recharging aquifer areas. The identified potential subsurface wastewater disposal sites, located throughout the Island of Nantucket will be evaluated for their ability to receive highly treated wastewater effluent from existing and/or potential wastewater treatment facilities.

The result of the water balance analyses confirms that in certain watershed subbasins the volume of groundwater removed as water supply is greater than the volume of groundwater recharge through on-site wastewater disposal systems. Potential subsurface wastewater disposal sites for highly treated wastewater effluent will be given a priority within the five identified stressed watershed subbasins for the design year of 2025. Recharge from stormwater will be considered for the Harbor subbasin during the evaluation and mapping project and recharge from a wastewater treatment facility will be considered for the Long and Madaket subbasins. The major and most important groundwater aquifer recharge to all these areas continues through annual precipitation.

Section 3.0

Screening of Sites for Treatment and/or Disposal

3.0 SCREENING OF SITES FOR TREATMENT AND/OR DISPOSAL

A. CRITERIA DEVELOPMENT

The screening criteria presented in this section was developed to assess the viability of 14 sites identified within Nantucket as potential wastewater treatment facility and/or wastewater disposal facility sites. The screening criteria used to evaluate these potential project sites was based upon eleven environmental criteria. The environmental screening criteria were chosen based upon review by the Project Proponent and upon comments received by the Proponent in the Secretary of the Executive Office of Environmental Affairs Certificate on the ENF dated October 2001. It was determined that by applying the screening criteria to the 14 identified sites a short list of selective potential sites would be established for additional evaluation through field testing. The screening criteria chosen to evaluate the potential project sites are: (1) wetlands; (2) soils; (3) drinking water supply - wellhead protection areas (Zone I and Zone II); (4) fisheries (including shellfish areas); (5) waterbodies (distance from surface water); (6) floodplains; (7) sensitive habitats; (8) park lands; (9) recreational resources; (10) agricultural/historical interests; (11) shoreline change data; and (12) in or adjacent to an Area of Critical Environmental Concern. A description of each screening criteria is given below and presented on Table 3-1.

The criteria was also developed with respect to whether or not there was an existing "Opportunity" or environmental "Constraint" for the site to be utilized for a treatment facility and/or disposal facility for Nantucket's wastewater.

The designation of an "Opportunity" within the screening criteria reflects the positive aspects of the environment that could be used in a beneficial manner in siting treatment and/or disposal facilities. Similarly, the designation of environmental "Constraints" within the screening criteria reflects aspects of the site and environment that would not be beneficial in siting these facilities. The "Constraints" are identified as "Minimal", "Moderate", and "Severe" depending on the extent and nature of the obstacles to developing each site. All sites were potentially located to avoid directly impacting any of the screening criteria.

TABLE 3-1
TOWN OF NANTUCKET
CWMP/FEIR
CRITERIA DESCRIPTION

Screening Criteria	Facility	Surface water Discharge	Groundwater Discharge
Wetlands [(a)]	**Opportunity**-N/A **No Constraint**-if greater than 200 feet from wetlands **Minimal Constraint**-if within 200 feet of wetlands **Moderate Constraint**-if within 100 feet of wetlands **Severe Constraint**-if within wetland	**Opportunity** if wetlands present adjacent to Site **No constraint** if within 200 feet of wetlands **Minimal constraint** if between 200 and 400 feet from wetlands **Moderate constraint** if between 400 and 1000 feet from wetlands **Severe constraint** if greater than 1000 feet from wetlands	**Opportunity** - N/A **No constraint** if greater than 1000 feet from wetland **Minimal constraint** if between 400 and 1000 feet from wetlands **Moderate constraint** if between 100 and 400 feet from wetland **Severe constraint** if within 100 ft of wetland
Soils	**Opportunity**-N/A **No Constraint**-based on mapped soil type **Minimal Constraint**- based on mapped soil type **Moderate Constraint**- based on mapped soil type **Severe Constraint**-if within known documented hazardous soil area	**No opportunity, minimal, or moderate constraint** based on mapped soil type **Severe constraint** if within known hazardous area	**Opportunity** if mapped within sand/gravel deposits **No constraint** - N/A **Minimal constraint** - N/A **Moderate constraint** - if mapped within till/bedrock **Severe constraint** if mapped within known hazardous area
Drinking Water Supply	**Opportunity** - N/A **No constraint** if outside Zone II **Minimal constraint** if within Zone II **Moderate constraint** - N/A **Severe constraint** - N/A	**Opportunity** - N/A **No constraint** if greater than 1000 feet from Zone II **Minimal constraint** - N/A **Moderate constraint** if within Zone II and greater than 1000 feet from public well **Severe constraint** if within Zone II and within 1000 feet from public well	**Opportunity** - N/A **No constraint** if greater than 1000 feet from Zone II **Minimal constraint** - N/A **Moderate constraint** if within Zone II and greater than 1000 feet from public well **Severe constraint** if within Zone II and within 1000 feet from public well
Fisheries and Shell Fish Beds	**Opportunity**-N/A **No constraint** if facility is downstream or greater than 1000 feet of fish stocking area **Minimal constraint** if facility is located within 400 feet from fish stocking area **Moderate constraint** if facility is located within 200 feet fish stocking area **Severe constraint** if facility is located directly in fish stocking area	**Opportunity** - N/A **No constraint** if discharge is downstream or greater than 1000 feet of fish stocking area **Minimal constraint** if discharge within 400 feet from fish stocking area **Moderate constraint** if discharge within 200 feet fish stocking area **Severe constraint** if discharge directly into fish stocking area	**Opportunity** - N/A **No constraint** if discharge downstream or greater than 1000 feet of fish stocking area **Minimal constraint** if discharge within 400 feet from fish stocking area **Moderate constraint** if discharge within 200 feet fish stocking area **Severe constraint** -N/A
Waterbodies [(a)]	**Opportunity**-N/A **No Constraint**-if greater than 200 feet from water body **Minimal Constraint**-if within 200 feet of water body **Moderate Constraint**-if within 100 feet of water body **Severe Constraint**-if within wetland	**Opportunity** if adjacent waterbody present **No constraint** if within 200 feet of waterbody **Minimal constraint** if between 200 and 400 feet from waterbody **Moderate constraint** if greater than 400 feet from waterbody **Severe constraint** if greater than 1000 feet from waterbody	**Opportunity** - N/A **No constraint** if greater than 1000 feet from waterbody **Minimal constraint** if between 200 and 1000 feet from waterbody **Moderate constraint** if within 200 feet from waterbody **Severe constraint** - N/A
Floodplains [(a)]	**Opportunity** - N/A **No constraint** if outside of floodplain **Minimal constraint** -N/A **Moderate constraint** - if within floodplain **Severe constraint** N/A	**Opportunity** - N/A **No constraint** if outside of floodplain **Minimal constraint** -N/A **Moderate constraint** - N/A **Severe constraint** if within floodplain	**Opportunity** - N/A **No constraint** if outside of floodplain **Minimal constraint** -N/A **Moderate constraint** - N/A **Severe constraint** if within floodplain
Sensitive Habitat [(a)]	**Opportunity** - N/A **No constraint** if outside of sensitive habitat **Minimal constraint** - N/A **Moderate constraint** if within sensitive habitat and greater than 100 feet from wetland **Severe constraint** if within sensitive habitat and within 100 feet from wetland	**Opportunity** - N/A **No constraint** if greater than 200 feet from sensitive habitat **Minimal constraint** if within 200 feet of sensitive habitat **Moderate constraint** if within sensitive habitat and greater than 100 feet from wetland **Severe constraint** if within sensitive habitat and within 100 feet from wetland	**Opportunity**- N/A **No constraint** if greater than 200 feet from sensitive habitat **Minimal constraint** if within 200 feet of sensitive habitat **Moderate constraint** if within sensitive habitat and greater than 100 feet from wetland **Severe constraint** if within sensitive habitat and within 100 feet from wetland
Park Lands	**Opportunity** - N/A **No constraint** if greater than 200 feet from park lands **Minimal constraint** if abutting park lands **Moderate constraint** - N/A **Severe constraint** if within park lands	**Opportunity** - N/A **No constraint** if greater than 200 feet from park lands **Minimal constraint** if abutting park lands **Moderate constraint** if within park lands **Severe constraint** - N/A	**Opportunity**- N/A **No constraint** if greater than 200 feet from park lands **Minimal constraint** if within 200 feet of park lands **Moderate constraint** if within park lands **Severe constraint** - N/A
Recreation Resources	**Opportunity** - N/A **No constraint** if greater than 200 feet from recreation resource **Minimal constraint** if within 200 feet of recreation resource **Moderate constraint** if within recreation resource area **Severe constraint** - N/A	**Opportunity** - N/A **No constraint** if greater than 200 feet from recreation resource[(b)] **Minimal constraint** if within 200 feet of recreation resource **Moderate constraint** if within recreation resource **Severe constraint** - N/A	**Opportunity** - N/A **No constraint** if greater than 200 feet from recreation resource **Minimal constraint** if within 200 feet of recreation resource **Moderate constraint** if within recreation resource **Severe constraint** - N/A
Agricultural/Historic Interests	**Opportunity** - N/A **No constraint** if greater than 200 feet from historic interest **Minimal constraint** if within 200 feet of historic interest **Moderate constraint** if directly abutting historic interest **Severe constraint** if within historic interest	**Opportunity** - N/A **No constraint** if greater than 200 feet from historic interest **Minimal constraint** if within 200 feet of historic interest **Moderate constraint** if directly abutting historic interest **Severe constraint** if within historic interest	**Opportunity** - N/A **No constraint** if greater than 200 feet from historic interest **Minimal constraint** if within 200 feet of historic interest **Moderate constraint** if directly abutting historic interest **Severe constraint** if within historic interest
Shoreline Change Data	**Opportunity** - N/A **No constraint** outside of area of documented erosion **Minimal constraint** if within 200 feet of **documented erosion** **Moderate constraint** if directly abutting **documented erosion** **Severe constraint if within area of documented erosion**	**Opportunity** - N/A **No constraint** outside of area of documented erosion **Minimal constraint** if within 200 feet of **documented erosion** **Moderate constraint** if directly abutting **documented erosion** **Severe constraint if within area of documented erosion**	**Opportunity** - N/A **No constraint** outside of area of documented erosion **Minimal constraint** if within 200 feet of **documented erosion** **Moderate constraint** if directly abutting **documented erosion** **Severe constraint if within area of documented erosion**
Area of Critical Environmental Concern (ACEC)[(a)]	**Opportunity** - N/A **No constraint** if outside of ACEC **Minimal constraint** -N/A **Moderate constraint** - N/A **Severe constraint** if within ACEC	**Opportunity** - N/A **No constraint** if outside of ACEC **Minimal constraint** -N/A **Moderate constraint** – N/A **Severe constraint** if within ACEC [(a)]	**Opportunity** - N/A **No constraint** if outside of ACEC **Minimal constraint** -N/A **Moderate constraint** – N/A[(a)] **Severe constraint** if within ACEC [(a)]
Nantucket and Madaket Harbor Watersheds	**Opportunity** - N/A **No constraint** if outside of Watershed Delineation **Minimal constraint** -N/A **Moderate constraint** - N/A **Severe constraint**-N/A	**Opportunity** - N/A **No constraint** if outside of Watershed Delineation **Minimal constraint** -N/A **Moderate constraint** - N/A **Severe constraint**-N/A	**Opportunity** - N/A **No constraint** if outside of Watershed Delineation **Minimal constraint** -N/A **Moderate constraint** - N/A **Severe constraint**-N/A

(a) Based on available information, potential sites were located to avoid directly impacting wetlands, floodplains, ACEC (Site specific), sensitive habitat (Site specific) and waterbodies and are at least 100 feet removed.

For those sites large enough to locate a facility or groundwater discharge site outside of any environmental criteria onsite, either a "No Constraint" or "Opportunity" rating was given due to the overall site size and availability of land outside of any environmental constraints.

- "Opportunity": the positive attributes associated with the criteria that could be a benefit to siting the facility (positive).
- "Constraint": the nature of the obstacles associated with the criteria that could negatively affect the siting of the facility.
    1. "No Constraint": the criteria does not have any positive attributes or impose any obstacles to the siting of the facility (neutral).
    2. "Minimal Constraint": the criteria imposes the lowest degree of obstacles in the siting the facility.
    3. "Moderate Constraint": the criteria imposes average obstacles to the siting the facility.
    4. "Severe Constraint": the criteria does impose extremely difficult obstacles to overcome in the siting the facility.

For the purposes of this report, it is presumed that treated effluent from any proposed facilities will be discharged to land, as the Massachusetts Ocean Sanctuaries Act prohibits ocean discharge of municipal wastewater off Nantucket. Although the Ocean Sanctuaries Act permits municipalities to apply for a waiver from its requirements, the Department of Environmental Protection would most likely deny the consideration of ocean discharge as an option, as it did during the Siasconset Facilities Planning Process. The Island is designated a Sole Source Aquifer, by the Environmental Protection Agency under the auspices of the Safe Drinking Water Act (Section 1424e) and gives the EPA the authority to review and restrict federal funding for projects that represent threats to the aquifer. Although "Surface Water Discharge" is defined in Table 3-1, any surface water discharges have been eliminated from consideration due to stringent regulatory requirements and the lack of suitable surface waters located on the Island. The surface fresh water bodies on Island are derived entirely from precipitation. Approximately 57 percent of the precipitation is returned to the atmosphere by evaporation and transpiration by plants. Significant amounts of this precipitation infiltrates the permeable sandy soils and recharge the underground aquifer. A limited amount results in surface water runoff directly into the Island's few streams ponds, and wetland areas. A perfunctory review of these streams, ponds and wetland areas located on Island identifies them as unsuitable for any treated effluent discharge due to not only their size but locations as well. The water resources for the Town are unique in that the fragile ecosystem survives on a system whereby fresh groundwater floats on top of salt water due to the density difference between salt and fresh. Surface water flow and the runoff from the land area is directly related to the topography of the Island's land area. Water moves from the higher to the lower elevations, which in Nantucket's case, is from center Island towards the shoreline. Ultimately this groundwater movement discharges to the ponds, wetland areas, and harbors or eventually in some areas to the open ocean.

At times of high groundwater, typically the spring months, many of these surface water bodies are flooded by the natural cause of events. For this reason alone, these surface water bodies cannot handle additional flow in the form of treated effluent.

Wetlands

The wetlands screening criteria is considered an important factor in siting both the treatment facilities and effluent disposal facilities. It was determined that "No Opportunities" exist for constructing treatment facilities or effluent disposal facilities in wetlands. These facilities would need to be constructed in upland areas to avoid filling or alternation of wetlands. The wetland related "Constraints" are based on distances from the wetland. The wetland screening criteria is developed with the assumption that the potential facilities will be greater than 100 feet away from wetland areas.

The wetlands criteria for surface water discharge facilities is considered more constrained the further removed from the wetland, since the discharge of the treated effluent ideally should be directly into the receiving water body. Those sites located within 100 feet of a wetland are considered to present "Minimal Development Constraints" because the proximity of the treatment facility and the length of the treated wastewater effluent discharge piping is minimized. Sites located distant (greater than 400 feet) from the wetland/surface water would pose "Moderate" and "Severe Constraints" since access to the discharge point is restricted.

Soils

Soil type is considered to have a greater influence on the selection of an effluent disposal/groundwater discharge site than on the selection of a treatment facility site due to the variable infiltration properties of soils. However, soil type is not as critical in selecting a treatment facility or surface water disposal site since construction is predominantly above ground.

The only "Constraint" associated with soil type for the construction of treatment facilities or surface water discharge facilities is the presence of known hazardous materials on site. The soil properties and the presence of hazardous material on site is considered primary to the selection of potential groundwater discharge sites.

To ensure proper function of an effluent disposal facility, a suitable site must have a soil permeability high enough to allow percolation of the effluent into the soil profile at a rate that will properly treat the effluent. Suitable soil types were determined by review of the Nantucket County Soil Survey Reports, developed by the U.S. Department of Agriculture's Soil Conservation Service. Soil types with slight or moderate limitations for sewage disposal will be considered to present "No Constraint" (slight) or "Minimal Constraint" (moderate) with regards to locating a subsurface effluent disposal/groundwater discharge system. Soil types with severe limitations for sewage disposal or soils mapped within hazardous areas will be considered to present "Severe Constraints" with regards to locating a subsurface effluent disposal/groundwater discharge system.

The soils within the Town of Nantucket are generally of four types. These soil types are listed below in descending order of the soil's suitability for potential groundwater discharge of treated effluent.

- Soil Type 1: Sand and Gravel Deposits – 0 to 50 feet deep
- Soil Type 2: End Moraines
- Soil Type 3: Till or Bedrock
- Soil Type 4: Landfill

Sites located within areas, which are comprised of Soil Type 1, are considered to provide the greatest "Opportunity". Soil Types 2, 3 and 4 are not considered suitable for effluent disposal, therefore, sites with these soil types are considered to have "Severe Constraints".

Floodplains

Construction within 100-year floodplains is constrained by regulatory restrictions on development within floodplain areas for protection of flood storage and for protection of the constructed facility to flood hazards. This criteria was considered to present "Moderate Developmental Constraints" with regard to siting of treatment facilities if located within a floodplain, and "No Constraint" if located outside of a floodplain.

Potential groundwater discharge sites located within the 100-year floodplain are restricted from being located in velocity zones and floodways in accordance with DEP regulations (310 CMR 15.213(2)). A facility in the 100-year flood plain would also be more susceptible to flooding during major storm events. Therefore, the floodplain site selection criterion was considered to present "Severe Developmental Constraints" for groundwater disposal facilities if the potential site is located within the floodplain. If the disposal site is outside the floodplain then "No Constraints" are present to development of a groundwater discharge facility. The 100-year flood plain was identified through review of the Federal Emergency Management Agency (FEMA) Flood Insurance Rate Maps for Nantucket, Community-Panel Numbers 250230 0001-0020. Sites with insufficient buildable area outside the flood plain were deemed unacceptable and were eliminated from consideration.

Surface water discharge facilities located within a floodplain are a concern since the discharge flow would represent additional flow that would have to be accommodated during the 100-year flood event. Most of the primary streams in Nantucket are associated with a floodplain. Therefore, potential flooding impacts could be buffered by the capability of the stream to handle slight increases in flow. Therefore, surface water discharges within a floodplain were eliminated from the evaluation as previously stated. If the disposal site is outside the floodplain then "No Constraints" are present to development

Waterbodies (Distance from Surface Water)

Although surface water discharges have been eliminated from consideration as previously mentioned, the following information regarding surface water discharges describe the usual process for evaluation and is for discussion purposes only.

Proximity to waterbodies is considered a factor in the siting of surface water and groundwater discharge locations. The location and construction of treatment facilities should not impact waterbodies if the facility is located greater than 100 feet from the waterbodies. The screening criteria for waterbodies is not considered to present "Developmental Constraints" on treatment facility sites regardless of the location outside the resource.

Surface water discharge sites are required to be located proximate to a surface waterbody. Therefore, this site selection criteria is accorded substantial weight in the surface water discharge site selection process when being considered. Those sites located proximate to surface waterbodies are considered to present an "Opportunity" for development. Those sites, which are not located proximate to a waterbody, are considered to present extensive "Developmental Constraints" regarding the surface water discharge site selection process.

Groundwater discharge sites should be located a sufficient distance from a surface water to ensure the facility does not affect the water quality of the surface water. The proposed subsurface disposal of effluent may result in the creation of a groundwater "mound" beneath the disposal field. The system should be sited such that the outer edges of the mound do not significantly influence the hydrology or water quality of the adjacent surface water body. Therefore, it was conservatively assumed that a groundwater discharge effluent bed should be at least 500 feet from a surface water body to provide an adequate margin of safety to ensure preservation of surface water quality. Potential groundwater discharge sites located at least 500 feet from a surface water body are considered to present an "Opportunity" for development. If within 500 feet, the site is considered to present "Moderate Constraints" for groundwater disposal.

Drinking Water Supply - Wellhead Protection Areas (Zone I and II)

The Town of Nantucket has an overlay district, the Public Wellhead Recharge District, designed to protect the Town's groundwater resource to ensure a safe and healthy public water supply (Nantucket Code Section 139-12B). Siting a wastewater treatment facility or an effluent disposal discharge in this overlay district is strictly prohibited. For this siting study, only sites with suitable area outside of the public wellhead protection district will be considered viable options.

Treatment facility sites, without an associated discharge on site, located in Zone II areas are not scrutinized the same as treatment facility sites with a groundwater discharge since the potential impacts to drinking water quality are minimal. Due to the importance of the Zone II resource areas, treatment facility sites located in Zone II areas are considered to present "Minor Developmental Constraints" while those located outside these areas are considered to present "No Constraints".

The proximity of surface water and groundwater discharge sites to public drinking water supplies is a significant criterion in the screening process due to the stringent regulatory restrictions which apply to siting these facilities within Zone I and II areas. This criterion is not given the same significance with respect to the siting of the treatment facilities since construction of a treatment facility does not necessarily include an effluent discharge. The screening criteria were developed to coincide with the requirements of the Nantucket Code (Zoning Overlay District), Massachusetts Drinking Water Regulations and the designation of Zone I (for wells with a yield of greater than 100,000 gpd, the Zone I is assumed to be 400 feet in radius) and Zone II (contributes to the well under severe pumping and recharge conditions).

Siting an effluent discharge is prohibited within a Zone I area. The location of a surface water or groundwater discharge within a Zone II area and greater than 1,000 feet from a public well is considered a "Moderate Constraint". In order to conservatively protect the Zone II areas, which are nitrogen sensitive, more stringent nitrogen discharge limitations have been established by DEP. Discussions with regulatory agencies regarding this matter suggest that an effluent discharge should not be considered unless all alternative options have been exhausted and a risk/benefit analysis has been performed. Current DEP policy allows for a wastewater discharge within Zone II's. Due to the higher levels of treatment and public concerns placed on siting wastewater discharge facilities within Zone II's, a "Severe Constraint" is identified for a discharge within 1,000 feet of a drinking water supply well within the Zone II. Location of a facility outside of the Zone II is viewed as having "No Constraint" for either a treatment facility or a discharge facility. Zone II areas were determined from the MASS GIS database and Town maps entitled "Public Wellhead District, Siasconset," prepared by Horsely, Witten and Heggemann, Inc. for the Siasconset Wellfield and "Public Wellhead Recharge District: Town" for the Wannacomet Wellfield.

Fisheries (Including shellfish beds)

The proximity of the potential facility site to fisheries resources, which includes shellfish beds, and adjacent waterbodies is a factor in siting surface water and groundwater discharge facilities. It was assumed that the location and construction of treatment facilities would not impact fisheries, if the facility is located greater than 100 feet from the waterbodies supporting the fisheries. The screening criteria for fisheries is considered to present "No Constraints" to development on treatment facility sites regardless of the location outside the resource.

Surface water discharge facilities pose the greatest threat to the fishery resources since the discharge of treated wastewater is directly into the waterbodies, which support the fisheries. Therefore, this criteria is considered to present a "Moderate Developmental Constraints" for a facility if it is located within 100 feet of a fish stocking area. If a site is located downstream or greater than 1,000 feet from a fish stocking area the site is considered to present "No Constraint" for the facility.

While groundwater discharges may impact fisheries, there is less risk of impact because the discharge is not directly into the surface water body, which contains the fisheries. Therefore, the criteria is only considered to present a "Minimal Constraint" for sites located within 400 feet of the fish stocking areas, and "No Constraint" for sites located greater than 1,000 feet from fish stocking areas. It was considered to be a "Moderate Constraint" if the facility site was located within 200 feet of the fisheries.

Sensitive Habitats

Sensitive habitats considered in the screening criteria include Estimated Habitats of Rare Wildlife, Certified Vernal Pools, Priority Sites of Rare Species Habitats and Exemplary Natural Communities, and Areas of Critical Environmental Concern. These habitats are sensitive to changes in the environment and are protected in both DEP Wetland Protection and Surface Water Quality Regulations. These regulations impose restrictions on development of any kind within the boundaries of these mapped habitats, and thus, for sites located within sensitive habitats, there is a "Severe Constraint" to development. Therefore, the "Constraints" to treatment facilities, surface water and groundwater disposal facilities is viewed to be equally restricted. The criteria identifies a "Severe Constraint" for those sites located within a sensitive habitat area, a "Minimal Constraint" if outside of, but abutting a sensitive habitat area, and "No Constraint" for those sites located a sufficient distance outside of a sensitive habitat area. Other sensitive habitats include park lands, recreational resources, and historical interests.

Park Lands and Recreational Resources

Land developed for recreational use or as park lands should be avoided in siting treatment facilities and disposal facilities (groundwater or surface water). If the existing land use of the potential site involves park or conservation lands or other recreational resources, construction of a treatment facility and/or disposal facility would represent an incompatible use conflict. Therefore, the presence of a park, conservation, or recreation land poses a "Severe Constraint" to development of a treatment facility. If the potential treatment facility site is located on property directly abutting the resources, then a "Minimal Development Constraint" exists on the site. If located greater than 200 feet from theses resource areas, the criteria is considered to present "No "Constraints" to development.

Groundwater and surface water discharge facilities do not impact these resources to the same extent the buildings and above ground structures associated with a treatment facility would. Therefore, these wastewater disposal facilities are only considered to present "Moderate Developmental Constraints" for sites located within the resource areas, and "Minimal Constraints" if the sites are located outside the resource areas and "No Constraints" to development if located greater than 200 feet from these resource areas.

Agricultural/Historical Interests

The proximity of the potential facilities (wastewater treatment facility and/or wastewater disposal facility) to historic resources is a factor that will be considered in siting the facilities. The Massachusetts Historical Commission State Register of Historic Places 2001 was consulted to determine the existence of historic resources within Nantucket. In addition to the presence of historic resources, the Massachusetts Historical Commission (MHC) has commented that there are many areas throughout the Island that could contain archaeological resources. The Massachusetts Historical Commission has noted that Nantucket has one of the highest densities of known archaeological sites in the Commonwealth.

In screening the potential project sites, it is considered desirable to select sites that do not impact these resources. The Massachusetts Historical Commission (MHC) is the jurisdiction notified of details regarding proposed projects in designated historic areas as well as the Nantucket Historic District Commission (NHDC). The MHC will then determine whether State Register properties exist within a project's area of potential impact. If it is determined that the proposed project will have an adverse effect, the applicant will be required to present a comprehensive analysis of alternatives. By eliminating these sites, the project will preserve the resources and avoid potential administrative and regulatory burdens associated with development in these areas. Since the developmental regulatory "Constraints" associated with these resources apply with equal force to either treatment facilities or disposal facilities, independent of any specific characteristics associated with the facilities, this screening criterion is considered to present the same "Constraints" for each facility. The criterion presents a "Severe Constraint" for those sites located within a historic resource area, a “Moderate Constraint” if directly abutting the site, a “Minor Constraint” if within 200 feet a historic resource area and “No Constraint” for those sites located greater than 200 feet outside of these resource areas.

Shoreline Change Data

The proximity of the potential or existing facilities to the Nantucket shoreline is a factor considered. The purpose of this parameter is to quantify the changes in shoreline position using the most accurate data sources and compilation procedures available and to characterize any areas of erosion and accretion. This criteria was utilized specifically for the current Surfside Facility.

An “Historical Shoreline Change Analysis for the Surfside, Nantucket Coastline”, which is an evaluation of the existing and potential erosion at the Surfside disposal bed area was conducted in 1999 and again in 2002 in order to determine the useful disposal area available at this specific site. The Woods Hole Group performed both studies, which looked at shoreline changes from 1846 to 2002. Refer to Appendix C for the complete reports.

In screening the potential for this type of site, it was considered desirable to select sites that are not affected with shoreline changes due to historical erosion. The criteria presents a “Moderate to Severe Constraint” for those sites located within an area of erosion and “No Constraint” for those sites outside of any erosion areas.

Nantucket and Madaket Harbor Watersheds

The proximity of the potential or existing facilities to the Nantucket Harbor Watershed, as described in a technical report entitled, “Nantucket Water Resource Management Plan,” 1990, by Horsley, Whitten & Hegemenn, Inc. and as delineated on a map entitled “Nantucket Harbor Watershed,” Nantucket GIS, dated January, 1999 and the Madaket Harbor Watershed area, of which the Horsley, Whitten & Hegemenn, Inc. plan was the principal source and was adopted by reference at the 2003 Town Meeting, are both factors that have been considered.

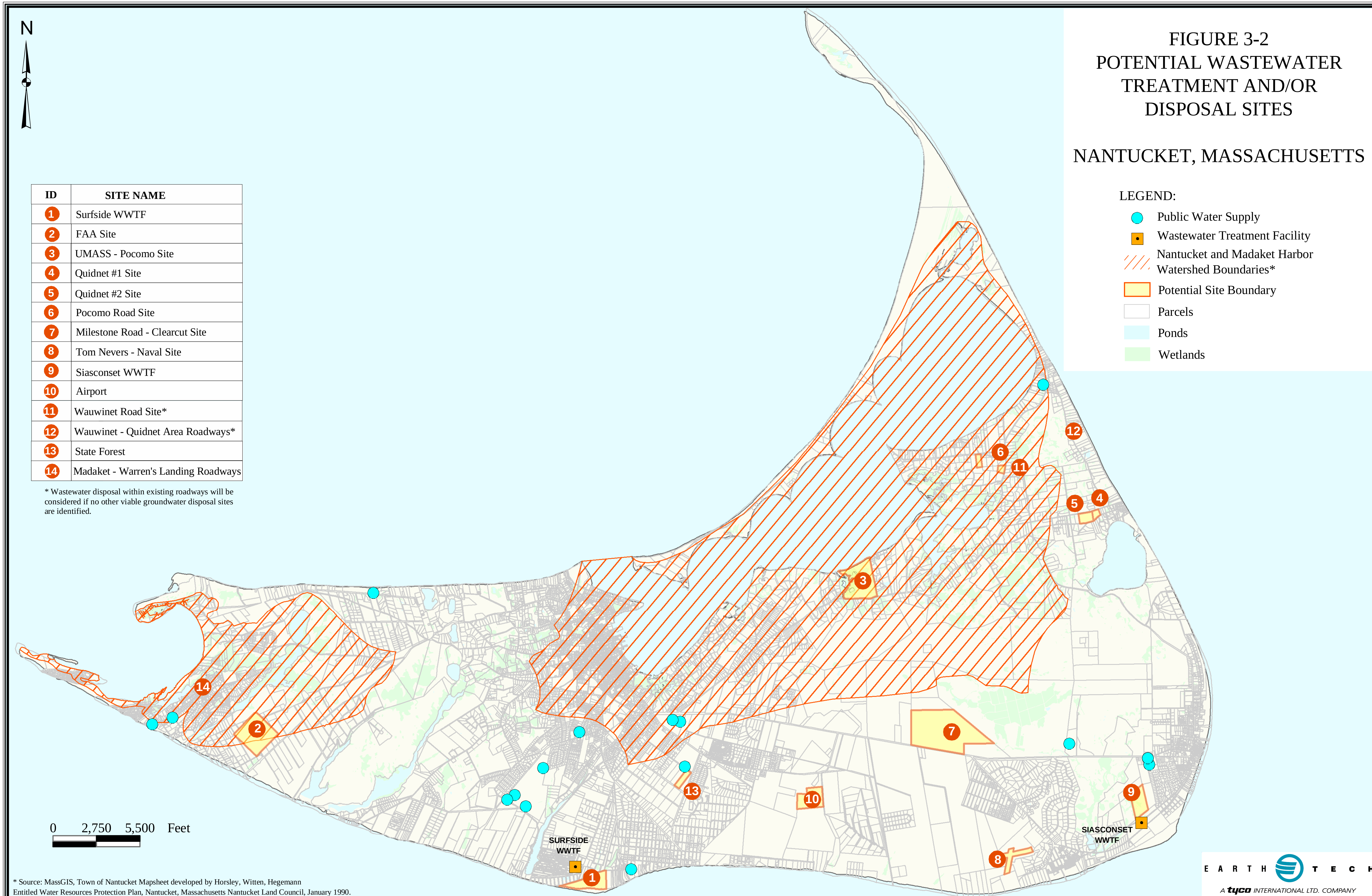
This site development criteria presents a unique environmental/sensitive receptor for each site based on the siting of a wastewater treatment facility and/or treated wastewater disposal facility. The designation of an “Opportunity” within the screening criteria reflects the positive aspects of the existing land use that could be used in a beneficial manner in the siting of any facilities. Similarly, the designation of environmental/sensitive receptor “Constraints” within the screening criteria reflect aspects of the site that would not be beneficial in the siting of these facilities. The siting of any facilities within these designated areas will be evaluated using the most stringent criteria and efforts will be made to avoid or minimize direct impacts to the screening criteria. Evaluations will be made depending on the nature and extent of any obstacles in the potential development of the site(s). In the context of the direct goals of this Project, the removal of problem and failing on-site wastewater disposal systems within any designated watershed area(s) to new wastewater treatment facilities, designed to treat and dispose of a highly treated wastewater effluent that is located within the boundaries of these designated areas, would be rated as an "Opportunity" as an environmental benefit would be achieved.

B. SITE IDENTIFICATION

1. General

The following section provides a description of the 14 sites identified as potential locations for local or centralized treatment facilities and/or groundwater treated effluent disposal locations. Refer to Figure 3-1 for site locations. The identification of sites in this section includes both properties and sites within larger parcels. Existing conditions and site features for each site are presented in Table 3-2, with respect to the screening criteria. Information used in the description of the sites was obtained from MassGIS data layers, Nantucket Master Plan, Nantucket Assessor records and USGS topographic maps. The information used to characterize the environmental conditions of these sites is viewed as conservative and appropriate for planning and screening purposes. Most of the sites screened in this analysis have been visited in the field and information gathered during these inspections is reflected in the details of the site. The information was supplemented by a field reconnaissance of the potential site locations with the existing conditions as represented on Figure 3-2.

The discussion describes the sites in terms of their location, the primary land use associated with the sites, and the significant site features and conditions. The search for potential sites involved a variety of previously described environmental parameters and also parcel size. Size is important to the type of facility proposed such as: (1) Centralized Treatment – undeveloped land of generally five acres or larger; and (2) Satellite Treatment-undeveloped land of generally one to two acres located within identified Need Area neighborhoods. The existing conditions for all 14 potential project sites were characterized based on the screening criteria previously outlined.



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SEPTEMBER 2003

TABLE 3-2
TOWN OF NANTUCKET
CWMP/FEIR
EXISTING CONDITIONS AND SITE FEATURES

Site Map/Parcel	Wetlands	Soils	Drinking Water Supply	Fisheries And Shell Fish Beds	Waterbodies	Floodplains	Sensitive Habitat	Park Lands	Recreation Resources	Agricultural/ Historic Interests	Shoreline Change Data	Nantucket and Madaket Harbor Watersheds
1. Surfside WWTF 87-87*	No Wetlands Onsite	Sand and Gravel Deposits	Outside of Zone II	No Fish Stocking Nearby	Ocean Nearby	Outside of Flood Plain	No Sensitive Habitat Nearby	None Located Within or Proximate	None Located Within or Proximate	None Documented Step 1 Review	No Erosion Data Reported	Outside of Harbor Watershed Delineations
2. FAA Site 63-9	No Wetlands Onsite	Sand and Gravel Deposits	Outside of Zone II	No Fish Stocking Nearby	Ocean Nearby	Outside of Flood Plain	No Sensitive Habitat Nearby	None Located Within or Proximate	None Located Within or Proximate	None Documented Step 1 Review	No Erosion Data Reported	Portions Within Harbor Watershed Delineations
3. UMass Site 26-1	Wetlands Onsite	Sand and Gravel Deposits	Outside of Zone II	No Fish Stocking Nearby	Ocean Nearby	Portions Within Flood Plain	Sensitive Habitat Nearby	None Located Within or Proximate	None Located Within or Proximate	None Documented Cursory Review	No Erosion Data Reported	Within Nantucket Harbor Watershed Delineation
4. Quidnet Area-1 21-36	No Wetlands Onsite	Sand and Gravel Deposits	Outside of Zone II	No Fish Stocking Nearby	No Waterbodies Nearby	Outside of Flood Plain	No Sensitive Habitat Nearby	None Located Within or Proximate	None Located Within or Proximate	None Documented Cursory Review	No Erosion Data Reported	Outside of Harbor Watershed Delineations
5. Quidnet Area-2 21-53	No Wetlands Onsite	Sand and Gravel Deposits	Outside of Zone II	No Fish Stocking Nearby	No Waterbodies Nearby	Outside of Flood Plain	No Sensitive Habitat Nearby	None Located Within or Proximate	None Located Within or Proximate	None Documented Cursory Review	No Erosion Data Reported	Outside of Harbor Watershed Delineations
6. Pocomo Area 14-72	No Wetlands Onsite	Sand and Gravel Deposits	Outside of Zone II	No Fish Stocking Nearby	No Waterbodies Nearby	Outside of Flood Plain	Sensitive Habitat Nearby	None Located Within or Proximate	None Located Within or Proximate	None Documented Cursory Review	No Erosion Data Reported	Outside of Harbor Watershed Delineations
7. Milestone Road 70-2	No Wetlands Onsite	Sand and Gravel Deposits	Outside of Zone II	No Fish Stocking Nearby	No Waterbodies Nearby	Outside of Flood Plain	Within Sensitive Habitat	Within or Proximate	Conservation Land	Potential Within	No Erosion Data Reported	Outside of Harbor Watershed Delineations
8. Tom Nevers Site 91-109	No Wetlands Onsite	Sand and Gravel Deposits	Outside of Zone II	No Fish Stocking Nearby	Ocean Nearby	Outside of Flood Plain	No Sensitive Habitat Nearby	None Located Within or Proximate	Proximate to Park	None Documented Cursory Review	No Erosion Data Reported	Outside of Harbor Watershed Delineations
9. Siasconset WWTF 74-52*	No Wetlands Onsite	Sand and Gravel Deposits	Outside of Zone II	No Fish Stocking Nearby	Ocean Nearby	Outside of Flood Plain	No Sensitive Habitat Nearby	None Located Within or Proximate	None Located Within or Proximate	None Documented Cursory Review	No Erosion Data Reported	Outside of Harbor Watershed Delineations
10. Airport Site	No Wetlands Onsite	Sand and Gravel Deposits	Outside of Zone II	No Fish Stocking Nearby	No Waterbodies Nearby	Outside of Flood Plain	Sensitive Habitat Nearby	None Located Within or Proximate	None Located Within or Proximate	None Documented Cursory Review	No Erosion Data Reported	Outside of Harbor Watershed Delineations
11. Wauwinet Road Area 14-29	Wetlands Onsite	Sand and Gravel Deposits	Outside of Zone II	No Fish Stocking Nearby	No Waterbodies Nearby	Outside of Flood Plain	Within Sensitive Habitat	None Located Within or Proximate	None Located Within or Proximate	None Documented Cursory Review	No Erosion Data Reported	Outside of Harbor Watershed Delineations
12. Wauwinet-Quidnet Roadways	No Wetlands Onsite	Sand and Gravel Deposits	Outside of Zone II	No Fish Stocking Nearby	Wetlands and Ocean Nearby	Portions Within Flood Plain	Within Sensitive Habitat	None Located Within or Proximate	None Located Within or Proximate	None Documented Cursory Review	No Erosion Data Reported	Portions Within Harbor Watershed Delineations
13. State Forest Sites	No Wetlands Onsite	Sand and Gravel Deposits	Within Zone II	No Fish Stocking Nearby	No Waterbodies Nearby	Outside of Flood Plain	Within Sensitive Habitat	Within or Proximate	Within or Proximate	Potential Within	No Erosion Data Reported	Outside of Harbor Watershed Delineations
14. Madaket-Warren's Landing Roadways	No Wetlands Onsite	Sand and Gravel Deposits	Outside of Zone II	No Fish Stocking Nearby	Wetlands and Ocean Nearby	Portions Within Flood Plain	Within Sensitive Habitat	None Located Within or Proximate	None Located Within or Proximate	None Documented Cursory Review	No Erosion Data Reported	Portions Within Harbor Watershed Delineations

*-Multiple Parcels
Notes: "Proximate to wetlands" is defined as within 400 feet, but greater than 100 feet
"Removed from wetlands" is defined as greater than 400 feet
"Proximate to stream/waterbody" is defined as within 200 feet

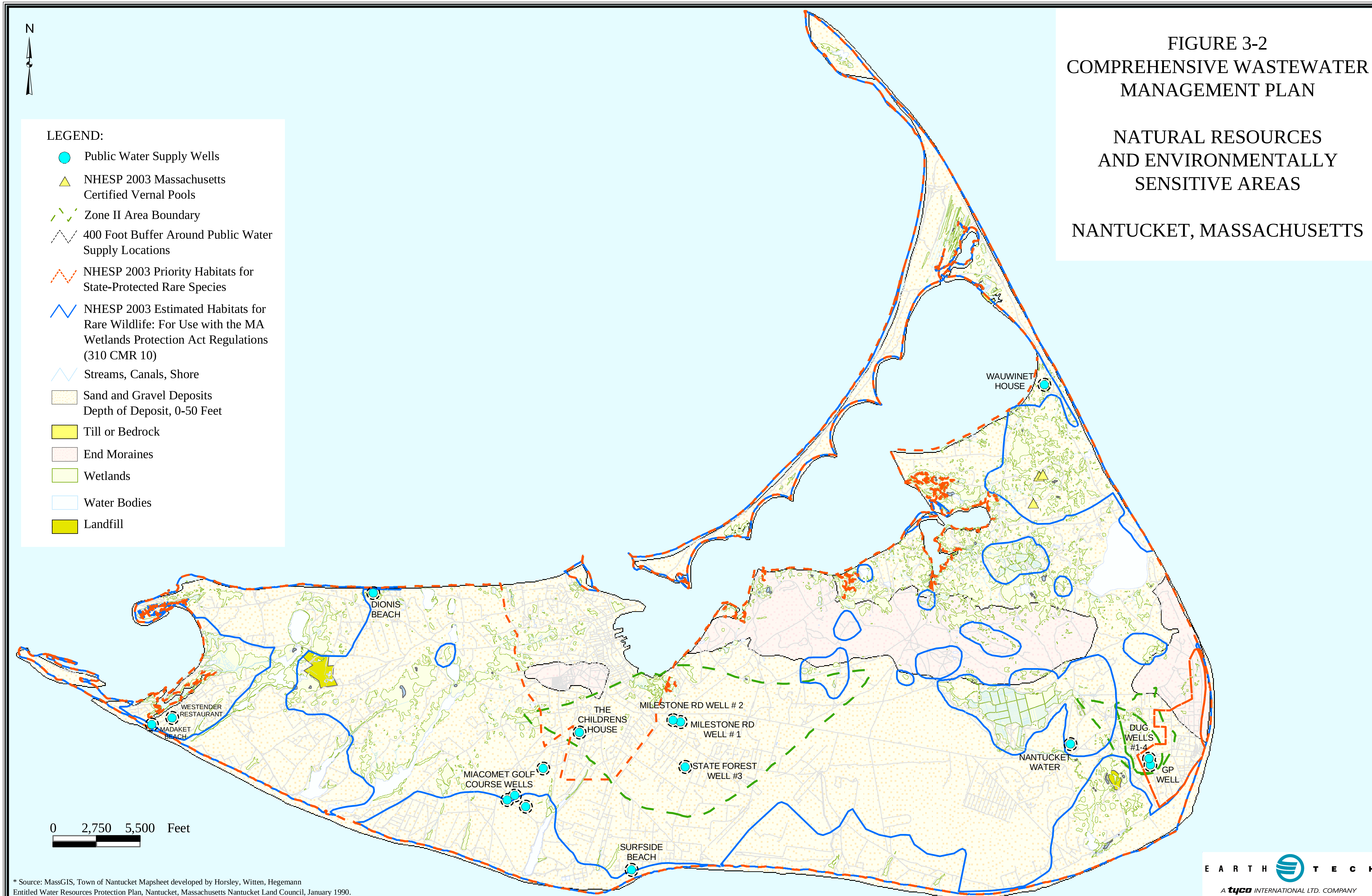

FIGURE 3-2
COMPREHENSIVE WASTEWATER MANAGEMENT PLAN

NATURAL RESOURCES AND ENVIRONMENTALLY SENSITIVE AREAS

NANTUCKET, MASSACHUSETTS

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1. Surfside Wastewater Treatment Facility - Assessor Map 87 and Multiple Parcels

This site is located on the southern tip of the Island directly east of Miacomet Pond and municipally owned. The site is the current location of the Town's main Wastewater Treatment Facility as well as nine open sand beds for discharge of the wastewater treated at this location. The Surfside Wastewater Treatment Facility currently treats flow from the center of Nantucket and has a design capacity of 2.24 MGD (the current DEP permitted flow is 1.8 MGD). The Surfside Wastewater Treatment Facility consists of a septage receiving tank, aerated grit chamber, three primary clarifiers that utilize ferric chloride and polymer for enhanced treatment, ten rapid infiltration basins, three aerated sludge holding tanks, one aerated septage equalization tank, and process support systems. Sludge and septage are dewatered with belt filter presses and can be mixed with wood chips in a portable mixer using aerated static pile method to produce a product that meets DEP Standards for a Type I sludge or composted with municipal solid waste.

The Town is currently working on a Preliminary Design Report for the upgrade and expansion of this Facility in order to handle additional flows based on the results of the Phase I CWMP/EIR. A hydrogeologic evaluation of the facility and discharge beds has been completed for this site and is included in Appendix E.

2. FAA Site - Massasoit Bridge Road - Assessor Map 63 and Parcel 9

This site is located east of Long Pond and west of Hummock Pond in the southwest corner of the Island, south of the Town department of Public Works and currently owned by the Federal Government. The site consists of a large open area, approximately 100 acres in size where the Federal Aviation Administration has maintained a tower with the land area covered in steel mesh to aid in the tower's reception. The site is large enough to accommodate buffers to the remote residential parcels in the area. The site immediately abuts land under the Nantucket Conservation Foundation. Evaluations at this site for soils and groundwater have been positive for the discharge of highly treated effluent and for the location of a package wastewater treatment facility.

A hydrogeologic evaluation of this site for the design and construction of a wastewater treatment facility and discharge beds for highly treated effluent has been completed and is included in Appendix F.

3. UMASS Site - Assessor Map 26, Parcel 1

This site is located on Polpis Road west of Polpis Harbor abutting Folgers Marsh. This site consists of approximately 100 acres and owned by the University of Massachusetts, Boston Campus. The school maintains the site and buildings located within the property. The property consists of large wetland areas on the westerly side, dry upland areas to the south and borders Polpis Harbor to the north.

4. Quidnet - No. 1 Site - Assessor Map 21, Parcel 53

This site is located within the village of Quidnet on Polpis Road northwest of Sesachacha Pond. This site consists of approximately five acres and is privately owned. The current land use for this parcel is identified in Town Assessor records as Accessory Land with Improvement. The property is fairly level and dry.

5. Quidnet - No. 2 Site - Assessor Map 21, Parcel 36

This site is located within the village of Quidnet on Polpis Road northwest of Sesachacha Pond. This site consists of approximately 13 acres and is privately owned. The current land use for this parcel is identified in Town Assessor records as Vacant Residential. The property is fairly level and dry.

6. Pocomo Road Site - Assessor Map 14, Parcel 72

This site is located off of the Wauwinet Road area on Pocomo Road just south of the Wauwinet Study Area. This site consists of approximately six acres and is privately owned. The current land use for this parcel is identified in Town Assessor records as Vacant Residential. The property is fairly level and dry.

7. Milestone Road - "Clear-cut Site" - Assessor Map 70, Parcel 2

This site is located directly on Milestone Road and is sometimes referred to as the "Clear-Cut" land. This site consists of approximately 223 acres and is owned and maintained by the Nantucket Conservation Foundation. The current land use for this parcel is identified in Town Assessor records as Tax Exempt. The property is level and dry.

8. Tom Nevers - Naval Station Site - Assessor Map 91, Parcel 109

This site is located in the village of Tom Nevers in the southeast shore of the Island just east of the village of Siasconset. This site consists of approximately 29 acres and is Town owned. The current land use for this parcel is identified in Town Assessor records as Municipal. The property is fairly level and dry.

9. Siasconset WWTF Site - Assessor Map 74, Parcel 52

This site is located within the village of Siasconset on property formerly under the jurisdiction of the United States Coast Guard. The new wastewater treatment facility is presently under construction at this site, with a design capacity of 0.22-mgd. There are 4 open sand beds located across the street on Low Beach road where the treated effluent is discharged.

10. Airport Site - Assessor Map 78, Parcel 3

This site is located on Town-owned property adjacent to the Nantucket Municipal Airport. The site consists of approximately 42 acres of undeveloped land and is fairly level and dry.

11. Wauwinet Road Site - Assessor Map14, Parcel 29

This site is located in the northeastern portion of the Island in the direction of the village of Pocomo. The site consists of approximately four acres and is privately owned. The current land use for this parcel as identified by Town Assessor records is Vacant Residential.

12. Wauwinet - Quidnet Area Roadways

This site includes the unpaved roadways in the villages of Wauwinet and Quidnet adjacent to the identified areas of need.

13. State Forest Site - Assessor Map 68, Parcel 70

This site is the Sate Forest parcel located near the center of the Island off of Old South Road. The site consists of approximately 39 acres of undeveloped land and is under the state's jurisdiction.

14. Madaket - Warren's Landing Area Roadways

This site includes the unpaved roadways in the villages of Madaket and Warrens Landing adjacent to the identified areas of need.

C. PRELIMINARY SITE SCREENING

1. Environmentally Sensitive Areas

Environmentally sensitive areas such as wetlands, flood plains, depth to groundwater, wellhead recharge/Zone Is/Zone IIs, surface waters, sensitive habitats and existing land use on each of the above sites was assessed. Any wetland/flood plains on site will be delineated according to appropriate federal and state guidelines. The functional value of the wetland as well as the potential to avoid or minimize impacts on, wetlands was determined. Wellhead recharge/Zone I/Zone II areas were delineated. The proximity of each site to these areas and the impacts of siting wastewater facilities was assessed. The characteristics of the groundwater at each site has been described. The effect, if any, on the groundwater at each site has been described. The effect of the project on groundwater quality has been assessed. Based upon groundwater investigations at the site, the surface waters potentially receiving flow from land application on the site have been identified. Each surface water body has been described in terms of existing conditions, use, and water quality issues. Impacts on surface waters from the wastewater discharge have been assessed to determine the level of treatment necessary at each site. Any area potentially affected by the activity, including downstream surface waters receiving groundwater from the site(s), has been surveyed for the presence of sensitive natural resources and receptors. This was accomplished by: (1) review of resource maps; (2) discussion with state, local and federal agency personnel; (3) field reconnaissance; and (4) review of readily available information. With the utilization of windshield surveys, existing maps, and discussions with appropriate local planning officials, and the availability of the EOEA Build-Out Analysis, the current and future land use at each site has been assessed.

2. Archaeological and Historical Resources

A review of existing information and the potential for significant historic and archaeological resources has been evaluated. The Massachusetts Historical Atlas/Register was reviewed for pertinent information on each identified site. A copy of the Project Notification Form (PNF) filed with MHC, which includes the Step 1 archaeological survey for the two short-listed sites is included in Appendix G.

3. MCP Phase I Site Assessment

A review of the Massachusetts Bureau of Waste Site Cleanup has been performed in order to determine the location of any hazardous materials on any of the identified sites. A complete listing can be found in Appendix H and at http://www.state.ma.us/cgi-bin/dep/wscreport.cgi.

4. Soil Suitability and Geologic Evaluation

Soil permeability and geologic conditions have been assessed at each site using existing data and maps such as the USDA Soil Conservation Services surficial geology maps and soil survey reports. Local Board of Health records were also used where applicable. Additionally, field testing was performed at each site to determine the ability of the soil at to allow percolation of wastewater effluent into the soil at a rate to properly treat the effluent. Depth to groundwater and site specific soil conditions have been assessed through field testing.

5. Sensitive Receptors

Sensitive receptors, which include the location of developed residential areas, schools, hospitals, nursing homes and commercial/industrial parcels within 500 feet of each site has been delineated. The potential impacts of odors, noise, traffic and visual aesthetics of construction and operation of any wastewater facilities to be located on each identified site in relation to the identified sensitive receptors have been assessed.

6. Hydrogeologic Evaluations

FAA Site

The following is a summary of the hydrogeological results of the FAA Site. Refer to Appendix F for the complete hydrogeological report as well as all tables and figures cited in this summary. The high groundwater conditions described in Section 3 and listed in Table 3-2 were used for all of the model simulations to predict the groundwater mound under discharge conditions. The proposed discharge area is approximately 340,000 square feet as shown in Figure 2-1. The proposed discharge rate is 351,000 gallons per day. The simulated groundwater mound at this discharge rate is shown in Figure 4-1.

The maximum groundwater mound is approximately 1.8 feet. The highest water table elevation beneath the discharge area is predicted to be approximately 5.8 feet. The lowest ground elevation at the site is currently about 17 feet. The groundwater modeling indicates that the proposed discharge can be easily accommodated at the site and still maintain the required separation distance of four feet from the top of the mound.

The three-dimensional groundwater flow model was coupled with a particle tracking model called PATH3D (Zheng, 1991) in order to illustrate the potential movement of groundwater over time and to predict the ultimate discharge of effluent-impacted groundwater generated at the site. Four particles were seeded at each of the 130 nodes representing the discharge area. The particles were tracked forward for a period of 30 years. The results of the particle tracking analysis are shown in Figure 4-2. The model predicts that approximately 76 percent of the effluent-impacted groundwater will discharge to the ocean. The remainder will discharge to Long Pond.

Surfside WWTF

The following is a summary from the hydrogeological report on the Surfside WWTF Site. Refer to Appendix E for the complete hydrogeological report as well as all tables and figures cited in this summary.

The high groundwater condition described Section 2 and listed in Table 2-1 was used for all of the model simulations to predict the groundwater mound under discharge conditions. The initial model runs indicated that the existing bed configuration would not be able to accommodate significantly greater flows while still maintaining a four-foot separation between the top of the mound and the bottom of the beds. Since there is sufficient land area for the construction of additional beds at the site, it was decided to use those potential beds in the maximum discharge simulation.

7. Historical Shoreline Analysis at Surfside Wastewater Treatment Facility

The Woods Hole Group performed historical shoreline analyses in the vicinity of the Surfside Wastewater Treatment Facility in 1999 and again in 2002. The completed reports and maps can be accessed in Appendix C.

D. IDENTIFICATION OF FEASIBLE SITES BASED ON SCREENING ANALYSIS

The screening criteria previously presented was applied to the 14 sites identified above. The preliminary screening of sites involved applying the 12 environmental criteria: (1) wetlands; (2) soils; (3) drinking water supply - wellhead protection areas (Zone I and Zone II); (4) fisheries (including shellfish areas); (5) waterbodies (distance from surface water); (6) floodplains; (7) sensitive habitats; (8) park lands; (9) recreational resources; (10) agricultural/historical interests; (11) shoreline change data; and (12) in or adjacent to an Area of Critical Environmental Concern. Each site was screened with respect to the potential for construction of a treatment facility and/or location of a groundwater discharge site.

As previously mentioned, the designation of an “Opportunity” within the screening criteria reflects the positive aspects of the environment that could be viewed as a benefit in siting these facilities. Similarly, the designation of environmental “Constraints” within the screening criteria reflects aspects of the site and environment that would pose limitations in siting the treatment and/or disposal facilities. The “Constraints” are identified as “Minimal”, “Moderate”, and “Severe” depending on the extent and nature of the obstacles to developing each site.

The feasible site or sites to accommodate the recommended wastewater facilities were identified upon the completion of the detailed screening described in the previous tasks. The results of this preliminary screening are presented in Table 3-3. This Table presents a rating of each site based on the application of the screening criteria. The sum of the opportunities and various “Constraints” are reflected in a rating of low, moderate or high potential for siting of a facility or disposal site. The rationale for the ratings is as follows:

- ○ High Potential = predominately “Opportunities” and “No Constraints”; may have a “Minimal” or “Moderate Constraint”.
- ◒ Moderate Potential = characterized by more than 1 “Moderate” and 1 “Minimal Constraint”.
- ● Low Potential = presence of a least one “Severe Constraint” plus a minimal, “Moderate” or additional “Severe Constraint”.

TABLE 3-3
TOWN OF NANTUCKET
CWMP/FEIR
RESULTS OF PRELIMINARY SCREENING

Site No.	Site Name	Wetlands	Soils	Drinking Water Supply	Fisheries	Waterbodies	Floodplains	Sensitive Habitat	Park Lands	Recreation Resources	Agricultural/ Historic Interests	Shoreline Change Data	Nantucket and Madaket Harbor Watersheds	Rating
1	**Surfside WWTF, 87-87***													
	Treatment Facility	No Constraint	No Constraint	No Constraint	No Constraint	No Constraint	No Constraint	No Constraint	No Constraint	No Constraint	No Constraint	No Constraint	No Constraint	○
	Groundwater Discharge	No Constraint	No Constraint	No Constraint	No Constraint	No Constraint	No Constraint	No Constraint	No Constraint	No Constraint	No Constraint	No Constraint	No Constraint	○
2	**FAA Site, 63-9**													
	Treatment Facility	No Constraint	No Constraint	No Constraint	No Constraint	No Constraint	No Constraint	No Constraint	No Constraint	No Constraint	No Constraint	No Constraint	No Constraint	○
	Groundwater Discharge	No Constraint	No Constraint	No Constraint	No Constraint	No Constraint	No Constraint	No Constraint	No Constraint	No Constraint	No Constraint	No Constraint	No Constraint	○
3	**UMass Site, 26-1**													
	Treatment Facility	No Constraint	No Constraint	No Constraint	No Constraint	Minimal	Minimal	Minimal	No Constraint	No Constraint	No Constraint	No Constraint	Minimal	◒
	Groundwater Discharge	No Constraint	No Constraint	No Constraint	No Constraint	Minimal	Minimal	Minimal	No Constraint	No Constraint	No Constraint	No Constraint	Minimal	◒
4	**Quidnet Area, 21-36**													
	Treatment Facility	No Constraint	No Constraint	No Constraint	No Constraint	No Constraint	No Constraint	No Constraint	No Constraint	No Constraint	No Constraint	No Constraint	No Constraint	○
	Groundwater Discharge	No Constraint	No Constraint	No Constraint	No Constraint	No Constraint	No Constraint	No Constraint	No Constraint	No Constraint	No Constraint	No Constraint	No Constraint	○
5	**Quidnet Area, 21-53**													
	Treatment Facility	No Constraint	No Constraint	No Constraint	No Constraint	No Constraint	No Constraint	No Constraint	No Constraint	No Constraint	No Constraint	No Constraint	No Constraint	○
	Groundwater Discharge	No Constraint	No Constraint	No Constraint	No Constraint	No Constraint	No Constraint	No Constraint	No Constraint	No Constraint	No Constraint	No Constraint	No Constraint	○
6	**Pocomo Area, 14-72**													
	Treatment Facility	No Constraint	No Constraint	No Constraint	No Constraint	No Constraint	No Constraint	No Constraint	No Constraint	No Constraint	No Constraint	No Constraint	No Constraint	○
	Groundwater Discharge	No Constraint	No Constraint	No Constraint	No Constraint	No Constraint	No Constraint	No Constraint	No Constraint	No Constraint	No Constraint	No Constraint	No Constraint	○
7	**Milestone Road, 70-2**													
	Treatment Facility	No Constraint	No Constraint	No Constraint	No Constraint	No Constraint	No Constraint	No Constraint	Minimal	Severe	Severe	No Constraint	No Constraint	●
	Groundwater Discharge	No Constraint	No Constraint	No Constraint	No Constraint	No Constraint	No Constraint	No Constraint	Minimal	Severe	Severe	No Constraint	No Constraint	●
8	**TomNevers-US Navy,91-109**													
	Treatment Facility	No Constraint	No Constraint	No Constraint	No Constraint	No Constraint	No Constraint	No Constraint	No Constraint	No Constraint	No Constraint	No Constraint	No Constraint	○
	Groundwater Discharges	No Constraint	No Constraint	No Constraint	No Constraint	No Constraint	No Constraint	No Constraint	No Constraint	No Constraint	No Constraint	No Constraint	No Constraint	○
9	**Siasconset WWTF, 74-52***													
	Treatment Facility	No Constraint	No Constraint	No Constraint	No Constraint	No Constraint	No Constraint	No Constraint	No Constraint	No Constraint	No Constraint	No Constraint	No Constraint	○
	Groundwater Discharge	No Constraint	No Constraint	No Constraint	No Constraint	No Constraint	No Constraint	No Constraint	No Constraint	No Constraint	No Constraint	No Constraint	No Constraint	○

○ High potential alternative

◒ Moderate potential alternative

● Low potential alternative

TABLE 3-3 (cont)
TOWN OF NANTUCKET
CWMP/FEIR
RESULTS OF PRELIMINARY SCREENING

Site No.	Site Name	Wetlands	Soils	Drinking Water Supply	Fisheries	Waterbodies	Floodplains	Sensitive Habitat	Park Lands	Recreation Resources	Agricultural/ Historic Interests	Shoreline Change Data	Nantucket and Madaket Harbor Watersheds	Rating
10	**Airport-78-1, 78-2, 78-3**													
	Treatment Facility	No Constraint	No Constraint	No Constraint	No Constraint	No Constraint	No Constraint	No Constraint	No Constraint	No Constraint	No Constraint	No Constraint	No Constraint	○
	Groundwater Discharge	No Constraint	No Constraint	No Constraint	No Constraint	No Constraint	No Constraint	No Constraint	No Constraint	No Constraint	No Constraint	No Constraint	No Constraint	○
11	**Wauwinet Area, 14-29**													
	Treatment Facility	Minimal	No Constraint	No Constraint	No Constraint	No Constraint	No Constraint	No Constraint	No Constraint	No Constraint	No Constraint	No Constraint	No Constraint	◒
	Groundwater Discharge	Minimal	No Constraint	No Constraint	No Constraint	No Constraint	No Constraint	No Constraint	No Constraint	No Constraint	No Constraint	No Constraint	No Constraint	◒
12	**Wauwinet –Quidnet Roadways**													
	Treatment Facility	No Constraint	No Constraint	No Constraint	No Constraint	Minimal	Minimal	No Constraint	No Constraint	No Constraint	No Constraint	No Constraint	No Constraint	◒
	Groundwater Discharge	No Constraint	No Constraint	No Constraint	No Constraint	Minimal	Minimal	No Constraint	No Constraint	No Constraint	No Constraint	No Constraint	No Constraint	◒
13	**State Forest Sites-Multiple Parcels**													
	Treatment Facility	No Constraint	No Constraint	No Constraint	No Constraint	No Constraint	No Constraint	Severe	Severe	Severe	Minimal	No Constraint	No Constraint	●
	Groundwater Discharge	No Constraint	No Constraint	No Constraint	No Constraint	No Constraint	No Constraint	Severe	Severe	Severe	Minimal	No Constraint	No Constraint	●
14	**Madaket-Warren's Landing Roadways**													
	Treatment Facility	No Constraint	No Constraint	No Constraint	No Constraint	No Constraint	Minimal	No Constraint	No Constraint	No Constraint	No Constraint	No Constraint	No Constraint	◒
	Groundwater Discharge	No Constraint	No Constraint	No Constraint	No Constraint	No Constraint	Minimal	No Constraint	No Constraint	No Constraint	No Constraint	No Constraint	No Constraint	◒

○ High potential alternative

◒ Moderate potential alternative

● Low potential alternative

The rating for each potential site, presented in the preliminary screening table, only considers the environmental factors that can influence the siting of a wastewater treatment and/or disposal facility. Engineering design considerations, constructability and/or political decisions may also influence final site selection.

As stated previously, all 14 sites identified as potential wastewater treatment and/or groundwater discharge sites are situated on a parcel of land or contiguous parcels of land that have an area greater than that needed for siting of these type facilities. In most cases, this allowed for the potential treatment facilities and/or groundwater discharge site(s) to be sited with the maximum available buffer from any of the 11-screening criterion. This enabled more potential sites to rate either a “No Constraint” or “Opportunity” designation due mainly to the overall area of the parcel(s) and availability of usable land within the parcel(s), which minimizes or eliminates potential environmental and/or other constraints.

E. SUMMARY

The Study Areas on Island rated as Need Areas, namely Wauwinet, Quidnet, Pocomo, Polpis, which are included in the study being completed by The Massachusetts Estuaries Project (MEP), will be evaluated further when the results of the Study are complete. At this point in time, we are recommending that these areas be managed under the Island’s Septage Management Plan. The MEP is in the process of addressing the issue of nitrogen loading in the Nantucket Harbor and Sesachacha Pond areas on Island and will develop the maximum amount of nitrogen (nitrogen threshold) that each estuary can tolerate without adversely changing its character or present use. When this final data is released from the MEP, a thorough evaluation of the MEP data will be made and a final recommendation will follow for these Study Areas.

Based on the preliminary screening criteria for those Needs Areas outside of the above-referenced, two of the 14 proposed groundwater disposal sites and proposed wastewater treatment facility sites rated favorably and are recommended for use as wastewater treatment facilities as well as groundwater disposal of the treated effluent: (1) Surfside Wastewater Treatment Facility; and (2) FAA Site.

Detailed evaluations including field-testing, of these two short list of favorable sites have been completed and are included in Appendices E and F. The number of wastewater treatment and/or groundwater disposal sites considered for detailed evaluation have been predicated on the land area required by the recommended wastewater management plan to support the treatment and disposal of wastewater in Nantucket. The detailed evaluation considers technical feasibility, economic viability and the most efficient use of the identified sites for the recommended wastewater management plan. Table 3-4 summarizes the sites considered the most favorable for siting of a wastewater treatment facility and/or groundwater disposal facility Island-wide with those in the MEP Study Areas, identified in Table 3-4 with Italics, being delayed from further review.

TABLE 3-4
TOWN OF NANTUCKET
CWMP/FEIR
WASTEWATER TREATMENT AND/OR DISPOSAL SITES

Site Number	Site Description	Groundwater Disposal	Wastewater Treatment Facility
1	Surfside WWTF - 87-87 (multiple parcels)	X	X
2	FAA Site - 63-9	X	X
3	*Umass - 26-1*	*X*	*X*
4	*Quidnet Area - 21-36*	*X*	*X*
5	*Quidnet Area - 21-53*	*X*	*X*
6	Pocomo Area - *14-72*	*X*	*X*
7	Milestone Road - 70-2	X	
8	Tom Nevers-US Navy - 91-6	X	
9	Siasconset WWTF - 74-52	X	X
10	Airport - 78-1 (multiple parcels)	X	
11	*Wauwinet Area - 14-29*	*X*	*X*
12	Wauwinet-Quidnet Roadways	X	
13	State Forest Site	X	
14	Madaket-Warrens Landing Roadways	X	

Section 4.0

Evaluation of Short Listed Alternatives

4.0 EVALUATION OF SHORT LISTED ALTERNATIVES AND PLAN SELECTION

A. ENVIRONMENTAL EVALUATION

1. Introduction

The three alternatives (Innovative/Alternative systems, connecting to the existing system, and communal systems) for the five Need Areas, whose evaluations were completed with this Report, were screened for direct and indirect impact. The direct and indirect impacts of the short listed alternatives were screened for building a new Madaket wastewater treatment facility at the FAA site, expanding the existing Surfside wastewater treatment facility, and providing sewer service to Madaket, Warren's Landing, Somerset, Shimmo, and Monomoy.

2. Evaluation

General

The alternatives were evaluated for the following direct impacts: (a) Historical, Archaeological, Cultural, Conservation and Recreation; (b) Wetlands, Flood Plains, and Agricultural Lands; (c) Zones of Contribution of Existing and Proposed Water Supply Sources; (d) Surface and Groundwater Resources Including Nantucket and Madaket Harbor Watersheds; (e) Displacements of Households, Businesses and Services; (f) Noise or Air Pollution or Odor and Public Health Issues Associated with Construction and Operation; (g) Violation of Federal, State or Local Environmental and Land Use Statutes.

In addition, the alternatives were evaluated for the following indirect impacts: (a) Changes in Development and Land Use Patterns; (b) Pollution Stemming from Changes in Land; (c) Damage to Sensitive Ecosystems; and (d) Socioeconomic Pressures for Expansion.

The following is a summary of each of the evaluation criteria.

Direct Impacts

Historical, Archaeological, Cultural, Conservation and Recreation

There are no known impacts to historical, archeological, cultural, conservation or recreational resources for any of the alternatives. A Step I Historical and Archeological Survey was conducted for the FAA site and the proposed expansion area of the Surfside Wastewater Treatment Facility. The survey showed that there would be no impacts on those sites. Refer to Appendix G for a copy of the Project Notification Form filed with the Massachusetts Historical Commission on these two sites.

While there are no known impacts, connecting the Madaket Needs Area and the Warren's Landing Needs Area to the existing wastewater treatment facility would have the most potential for impact. Due to the considerable distance, if sewers were installed from these Needs Areas to the existing wastewater infrastructure, it would make the Island more vulnerable to impacts to historical and archeological impacts.

It is possible that there would be impacts associated with the installation of I/A systems in all of the areas of need, but the individual property owners would install the systems and would be required to review the impact on the installation of the systems on any Historical, Archaeological, Cultural, Conservation and Recreation resources.

A review of the Massachusetts Natural Heritage Atlas (11^{th} Edition) indicates that the proposed FAA and Surfside expansion sites are within areas designated as Priority and Estimated Habitat for rare wildlife and plant species. Earth Tech requested data on rare, threatened, and endangered species in the project area from the Massachusetts Natural Heritage and Endangered Species Program (MNH&ESP). In January 2004, MNH&ESP responded with a list of plant and animal species know to occur in the vicinity of each site.

In August of 2003, botanists from Buckley Botanical Consultants completed a preliminary investigation of each site. At that time no rare plants were discovered. Once final site designs are chosen, the Town of Nantucket will work with MNH&ESP to develop a plan to complete an extensive survey of each site to determine the occurrence and likely impact to any rare, threatened, or endangered species.

Wetlands, Flood Plains, and Agricultural Lands

There is a potential for temporary impacts to wetlands from each of the alternatives. All three alternatives potentially impact the 100-foot wetland buffer zone. The impacts would be temporary and associated with the construction of sewer infrastructure. Any impacts would be mitigated by erosion control during construction. The Conservation Commission and the DEP will review all erosion control measures during the Notice of Intent process.

Zones of Contribution of Existing and Proposed Water Supply Sources

None of the treatment alternatives will impact the Zones of Contribution. The contribution zones for the water supply sources do not fall into the areas of any of the alternatives.

Surface and Groundwater Resources Including Nantucket and Madaket Harbor Watersheds

The I/A systems would have a negative impact in all of the proposed sewered areas. While the I/A systems provide a higher level of treatment than current on-site wastewater disposal systems, the I/A systems do not provide the same level of treatment as an advanced wastewater treatment facility. Since some of the areas have close proximities to the Nantucket and Madaket Harbor Watersheds it will be required that any wastewater treatment system achieve a high level of treatment. Communal systems in Somerset, Shimmo and Monomoy would have negative impact on water resources because of the constraints on available land and high volume of wetland areas. There are no available parcels of land in these areas that would provide for the required buffer zones around water resources.

Displacements of Households, Businesses and Services

Communal systems in the Somerset, Shimmo and Monomoy areas would have a severe constraint regarding displacement of households, businesses and services. There are currently no available land parcels in these areas that would meet the requirements for communal systems. If communal system were required in these areas, then parcels would have to be taken by Eminent Domain and would displace residential property owners.

Noise Pollution, Air Pollution, Odor and Public Health Issues Associated with Construction and Operation

There will be some temporary construction noise associated with all of the alternatives. Limiting the hours and the days of construction will mitigate the construction noise impacts. There may be additional noise impacts associated with expanding the Surfside Wastewater Treatment Facility due to the additional treatment processes. Additionally, the residential areas are so dense in Somerset, Shimmo and Monomoy that communal systems would cause impacts associated with noise pollution, air pollution, and odor issues. Any impacts associated with these alternatives will be mitigated in the final design.

Violation of Federal, State or Local Environmental and Land Use Statutes or Regulations and Plans Imposed by Such Statutes and Regulations

None of the alternatives would violate any of the Federal, State or Local Environment and/or Land Use Statutes or Regulations and plans imposed by any of the statutes and regulations.

Indirect Impacts

Changes in Development and Land Use Patterns

Connecting the proposed sewer infrastructure to the existing wastewater treatment facility would impact land use and development patterns in Madaket and Warren's Landing. These areas are not in close proximity to the existing facility. A connection would have to be across open space and several buildable parcels. An expansion of this magnitude would open up these areas and the areas along the way to significant development.

Building a communal system on the FAA site would have positive impact to the Madaket and Warren's Landing area. The parcel has the potential for high density development with the current zoning and land use. This kind of development would cause a long-term negative change in development and land use patterns.

Communal systems in Somerset, Shimmo and Madaket would have a negative impact to the areas in regards to land use patterns. Currently, there are no parcels available for development of a communal system in these area, the Town would have to change the land use of several parcels in order to accommodate a communal system.

Pollution Stemming from Changes in Land Use

Connecting the proposed sewer infrastructure to the existing wastewater treatment facility would impact land use and development patterns in Madaket and Warren's Landing. These changes in development and land use would cause noise pollution, impacts to historical and cultural resources, impacts to water resources, and impacts to Long Pond and Madaket Harbor Watershed.

Building a communal system on the FAA site would have positive impact to land use in the Madaket and Warren's Landing area. New, high density development on this site would have a negative environmental impact on Long Pond and Madaket Harbor Watershed.

Land Use patterns would have to be changed for communal systems in Somerset, Shimmo. Communal systems in dense residential areas could have negative impact on noise pollution, odor pollution and the water resources, such as wetlands.

Damage to Sensitive Ecosystems

I/A systems would negatively impact the sensitive ecosystems of all of the proposed sewer expansion areas. I/A systems do not treat wastewater to as high of a level of treatment as wastewater treatment facilities. The wastewater effluent from I/A systems has the potential to negatively impact wetlands, and harbor watershed areas.

Connecting Madaket and Warren's Landing to the existing wastewater treatment facility at Surfside would include construction along a significant distance. This construction would go through an increased amount of wetland buffer zone areas.

There are currently no available parcels in Somerset, Shimmo and Monomoy for communal systems. If a communal system was built on one of the available parcels, it would negatively impact sensitive ecosystems, such as wetlands and harbor watersheds because of the poor soils and shallow depth to groundwater.

Socioeconomic Pressures for Expansion

Socioeconomics would not be affected by I/A systems or communal systems because these systems would be designed to treat only the exiting systems. Connecting Madaket and Warren's Landing to the exiting facilities may affect Socioeconomics. The expansion could cause increased development and negatively impact the socioeconomics in regard to several factors associated with development, such as increased budget need for items such as school systems, maintenance of roadways, fire protection and other Town services. The Town and its consultant are working to develop a plan that will not promote nor deny growth. Low-pressure sewers and the establishment of "Sewer Districts" are both being considered at this time. The Town will have regulations in place before any recommendation is implemented in order to ensure the Island's future sustainability.

3. Recommendations Based on Environmental Evaluation Criteria

Table 4-1 summarizes the evaluation of the environmental criteria with regards to Innovative/Alternative Systems for the five Need Areas. The evaluation indicates that Innovative/Alternative Systems for all of the Study Areas have an equal number of impacts and therefore is not considered a high potential alternative. Innovative/Alternative System would not impact the existing Surfside WWTF nor require the construction of the Madaket WWTF and therefore is not applicable to this evaluation.

Table 4-2 summarizes the evaluation of the environmental criteria with regards to Connection to the Existing System for the five Need Areas and Surfside WWTF Expansion. The evaluation indicates that a Connection to the Existing System for Mononoy, Somerset, and Shimmo Study Areas has the least impacts and therefore is considered the highest potential alternative. Connection to the Existing System would not require the construction of the Madaket WWTF and therefore is not applicable to this evaluation.

TABLE 4-1
TOWN OF NANTUCKET
CWMP/FEIR
INNOVATIVE/ALTERNATIVE SYSTEM EVALUATION

	Direct Impacts							Indirect Impacts			
Description	Historical, Archaeological, Cultural, Conservation and Recreation	Wetlands, Flood Plains, and Agricultural Lands	Zones of Contribution of Water Supply Sources	Surface and Groundwater Resources	Displacements of Households, Businesses and Services	Construction and Operation Pollution	Violation of Land Use Statutes	Changes In Land Use Patterns	Pollution Stemming from Changes in Land	Damage to Sensitive Ecosystems	Socioeconomic Pressures for Expansion
Madaket WWTF at FAA Site	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**
Surfside WWTF Expansion	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**
Madaket	○	◒	○	◒	○	◒	○	○	○	◒	○
Monomoy	○	◒	○	◒	○	◒	○	○	○	◒	○
Shimmo	○	◒	○	◒	○	◒	○	○	○	◒	○
Somerset	○	◒	○	◒	○	◒	○	○	○	◒	○
Warren’s Landing	○	◒	○	◒	○	◒	○	○	○	◒	○

○ High potential alternative, no impact

◒ Moderate potential alternative, minimal constraints

● Low potential alternative, severe constraints

TABLE 4-2
TOWN OF NANTUCKET
CWMP/FEIR
CONNECTION TO THE EXISTING SYSTEM EVALUATION

	Direct Impacts							Indirect Impacts			
Description	Historical, Archaeological, Cultural, Conservation and Recreation	Wetlands, Flood Plains, and Agricultural Lands	Zones of Contribution of Water Supply Sources	Surface and Groundwater Resources	Displacements of Households, Businesses and Services	Construction and Operation Pollution	Violation of Land Use	Changes In Land Use Patterns	Pollution Stemming from Changes in Land	Damage to Sensitive Ecosystems	Socioeconomic Pressures for Expansion
Madaket WWTF at FAA Site	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**	**N/A**
Surfside WWTF Expansion	○	○	○	○	○	◒	○	○	○	○	○
Madaket	◒	◒	○	○	○	○	○	◒	◒	◒	◒
Monomoy	○	◒	○	○	○	○	○	○	○	○	○
Shimmo	○	◒	○	○	○	○	○	○	○	○	○
Somerset	○	◒	○	○	○	○	○	○	○	○	○
Warren's Landing	◒	◒	○	○	○	○	○	◒	◒	◒	◒

○ High potential alternative, no impact

◒ Moderate potential alternative, minimal constraints

● Low potential alternative, severe constraints

Table 4-3 summarizes the evaluation of the environmental criteria with regards to the Communal System for the five Need Areas, Surfside WWTF Expansion, and Madaket WWTF Construction. The evaluation indicates that a Communal System for Madaket and Warren's Landing Study Areas has the least impact and therefore is considered the highest potential alternative.

The analysis of impacts indicates that the best alternative for wastewater disposal problems in the Madaket and Warren's Landing Study Areas is to construct a communal WWTF at the FAA site, and the best alternative for wastewater disposal problems in the Somerset, Shimmo and Monomoy Study Areas is to connect to the existing Surfside WWTF.

B. EVALUATION OF COSTS

1. Project Costs

Cost estimates have been prepared for the various alternatives for the areas of wastewater disposal need. The presentation of costs is preliminary in nature and contains construction, construction contingencies, administrative, legal, design engineering, and construction engineering. Construction costs are based upon present day, competitively bid construction work prices and on an Engineering News Record (ENR) Construction Cost Index of 6741 for September 2003. We recommend that budget costs be updated periodically prior to each construction phase.

TABLE 4-3
TOWN OF NANTUCKET
CWMP/FEIR
COMMUNAL SYSTEM EVALUATION

	Direct Impacts							Indirect Impacts			
Description	Historical, Archaeological, Cultural, Conservation and Recreation	Wetlands, Flood Plains, and Agricultural Lands	Zones of Contribution of Water Supply Sources	Surface and Groundwater Resources	Displacements of Households, Businesses and Services	Construction and Operation Pollution	Violation of Land Use	Changes In Land Use Patterns	Pollution Stemming from Changes in Land	Damage to Sensitive Ecosystems	Socioeconomic Pressures for Expansion
Madaket WWTF at FAA Site	○	○	○	○	○	◒	○	○	○	○	○
Surfside WWTF Expansion	○	○	○	○	○	◒	○	○	○	○	○
Madaket	○	◒	○	○	○	○	○	○	○	○	○
Monomoy	○	◒	○	◒	●	◒	○	◒	◒	◒	○
Shimmo	○	◒	○	◒	●	◒	○	◒	◒	◒	○
Somerset	○	◒	○	◒	●	◒	○	◒	◒	◒	○
Warren's Landing	○	◒	○	○	○	○	○	○	○	○	○

○ High potential alternative, no impact

◒ Moderate potential alternative, minimal constraints

● Low potential alternative, severe constraints

Costing of Off-Site Wastewater Disposal Alternatives

For the areas of wastewater disposal need where off-site wastewater disposal alternatives are being considered, the project costs for conventional gravity sewers with pumping stations versus low-pressure sewers were estimated. The estimated project costs are based on the following:

- Collector and Interceptor Sewers and appurtenances are estimated to be $275 per linear foot for pipes ranging in size from 8 inches to 12 inches;
- Pumping Stations are estimated to be $750,000 per pumping station;
- Force Mains and appurtenances are estimated to be $200 per linear foot for pipes ranging in size from 3 inches to 6 inches;
- Low Pressure Sewers and appurtenances are estimated to be $175 per linear foot for pipes ranging in size from 1-1/2 inches to 3 inches;
- Low Pressure Sewer Pumping System estimated at $12,500 each and includes the purchase and installation of the pumping unit, control panel, piping and abandonment of the existing on-site wastewater disposal system;
- Design Engineering is estimated to be ten (10) percent of Construction Cost;
- Construction Engineering is estimated to be ten (10) percent of Construction Cost;
- Administrative, Fiscal and Legal Costs are estimated to be five (5) percent of Construction Cost;
- Land Takings for pumping stations are estimated at $250,000 per acre and that ½ acre of land is required for each pumping station. The cost estimates assumes that no other Land Takings and/or Easement are required;
- Sub-Total of Project Cost includes all items listed above;
- Contingency is estimated to be twenty (20) percent of the Construction Cost; and
- Total Estimate Project Cost includes Sub-Total Project Cost plus Contingency.

Costing of On-Site Innovative/Alternative Systems

Since the treatment capabilities as well as the costs of the innovative/alternative (I/A) technologies are similar, one on-site I/A technology, FAST® System, was selected in order to evaluate the wastewater disposal alternatives for the areas of wastewater disposal need. The Single Home FAST® System can accommodate flows up to 440 gallons per day (gpd). The site conditions on each property play a major role in the costing of I/A systems. It has been assumed that each property has enough usable land to accommodate its existing septic tank, a FAST® system, pump chamber, necessary piping, distribution box, and a rectangular leaching area. The areas of wastewater disposal need where I/A systems are being considered have either 30 percent or more of the study area with severe soil limitations (hardpan, bedrock, slope, flooding and wetness) or 20 percent or more of the study area with severe groundwater limitations (seasonally high water table at the surface to 2 feet deep). These site conditions contribute to the construction cost of the

I/A system. For the areas of wastewater disposal need where on-site I/A systems are being considered, the construction costs of two different FAST® systems have been estimated. The effluent loading rates, leaching area requirements, and I/A system credits are based on the requirements/provisions of Title 5. These systems are described in the following paragraphs.

Case 1: Single Home FAST® System

Design Flow of 440 gpd, Poor Soils, Suitable Depth to Groundwater

This system includes the existing septic tank, a Single Home FAST® System, piping, distribution box and leaching trenches. It has been assumed that the poor soils within the study area have a percolation rate of 60 minutes per inch (mpi), which as per Title 5, require an effluent loading rate of 0.15 gpd/SF. It has been assumed that the effective leaching area of each trench includes the bottom of the trench (2 feet) and a maximum of 2 feet of each sidewall. Therefore each trench provides 6 SF of leaching area per linear foot of trench. Title 5 allows a credit of a 50 percent reduction in leaching area with the use of an I/A system. Based on these requirements, each system requires 245 linear feet of leaching trench. Therefore, this system includes a 72-foot by 36-foot leaching area consisting of four 62-foot long leaching trenches with a distance of 6 feet between trenches. The area between the trenches is the designated reserve area.

Case 2: Single Home FAST® System

Design Flow of 440 gpd, Suitable Soils, Poor Depth to Groundwater

These systems include the existing septic tank, a Single Home FAST® System, a pump and pump chamber, piping, distribution box and mounded leaching trenches. It has been assumed that the suitable soils within the study area have a percolation rate of 10 mpi, which as per Title 5, require an effluent loading rate of 0.60 gpd/SF. It has been assumed that the effective leaching area of each trench includes the bottom of the trench (2 feet) and a maximum of 2 feet of each sidewall. Therefore each trench provides 6 SF of leaching area per linear foot of trench. Since this system is located in an area with shallow depth to groundwater, the leaching area needs to be raised in order to meet Title 5 requirements. A pump chamber is required to pump the FAST® System effluent to the elevated leaching trenches. Title 5 allows a credit of a 2-foot reduction in depth to groundwater with the use of an I/A system. This system requires a 2-foot mound to provide adequate separation between the bottom of the leaching area and groundwater. Based on these requirements, each system requires 123 linear feet of leaching trench. Therefore, this system includes a 41-foot by 36 foot leaching area consisting of four 31-foot long leaching trenches with a distance of 6 feet between trenches. The area between the trenches is the designated reserve area.

The estimated construction costs for the FAST® systems are estimated at $50,000 each. The estimated construction cost is based on the following:

- Single Home FAST® System requires a 2,000 gallon tank and/or pump chamber;
- Single Home FAST® System requires 4 days for installation;
- Filter fabric and washed stone are used within leaching trenches;
- Site will be loam and seeded after construction of I/A system;
- Contractor's payroll burden is approximately 50 percent of labor cost;
- Contractor's overhead and profit is approximately 15 percent of material, equipment and labor cost; and
- Construction contingency is approximately 20 percent of the total construction cost.

2. Operation and Maintenance Costs

Operation and Maintenance Costs for Off-Site Wastewater Alternative

The annual operation and maintenance (O&M) costs for the design year has been estimated and is assumed to be approximately the same for each alternative. The costs include estimated manpower, electrical power, supplies, equipment and maintenance for the gravity sewers, pump stations, force mains, wastewater treatment facilities and groundwater disposal sites. In order to maximize the life of the system, particularly the pumping stations and wastewater treatment facilities, a comprehensive O&M program is recommended. This will require a full time operating staff that will perform daily, weekly and monthly tasks in order to achieve this goal. Therefore, the largest factor in the O&M costs for each of the alternatives is labor. It has been assumed that other Town resources will be used to aid in the operation of the system including billing, and sharing of equipment and manpower during emergencies. The O&M costs are based on the following:

- Operating Staff
  - Staff for WWTFs, pumping stations and wastewater infrastructure has been estimated to include: 1 superintendent, 1 administrative assistant, 1 clerical staff, 1 laboratory technician, 4 operators and 4 laborers
  - Staff for Septage Management Plan has been estimated to include: 1 superintendent, 1 administrative assistant
  - Staffing Cost estimated at an average of $27.50 per hour per person including benefits
- Power Cost estimated at $0.15 per kilowatt hour with each system/pump operating for 6 hours per day
- Yearly cost for supplies, spare parts, lubrication and calibration of measurement
  - Wastewater Treatment Facilities estimated at $52,500 per year
  - Pumping Stations estimated at $10,000 per station
- Compliance Monitoring and Testing
  - Wastewater Treatment Facilities Management Plan at $40,000 per year
  - Pumping Stations at $5,000 per station
  - Septage Management Plan at $1,000 per week.
- Maintenance Contract including yearly inspection, supplies, spare parts, and lubrication for Low Pressure System Pumping Unit estimated at $500 per unit
- O&M costs include items such as chemicals, telephone, postage, permit fees, legal, accounting, insurance, taxes and assessments, principal and interest on loans, and fuel
- Present Worth Cost based on 20 years at 7 percent interest (10.594).

Operation and Maintenance Costs for On-Site Innovative/Alternative Systems

Operation and maintenance of the FAST® System includes septic tank pumping, blower maintenance, periodic inspections, and electrical costs. Depending on the approval and permit issued by DEP, water quality testing may also be required. Septic tank pumping should be performed on a regular basis such as once every two to three years. The cost of this service is about $200 per pump-out. Yearly maintenance service contracts may be obtained through the manufacturer's representative of the FAST® System. The service contract includes the four service visits, which are required by DEP. The estimated costs of the service contracts for the Single Home FAST® System is estimated $500 per year. Water quality testing is required on a quarterly basis and is estimated at $250 per year. Annual electrical cost for a Single Home FAST® System is estimated at about $25 a month or approximately $300 per year. Therefore the total annual operation and maintenance cost for a Single Home FAST® System is estimated $1,150.

3. Wastewater Treatment Facilities Alternative Costs

An estimated construction cost was developed for two of the alternatives for the Surfside WWTF. Table 4-4 presents the estimated construction cost for the Surfside WWTF.

TABLE 4-4
TOWN OF NANTUCKET
CWMP/FEIR
SURFSIDE WWTF ALTERNATIVES
ESTIMATED CONSTRUCTION COSTS

Alternative Number	Description	Estimated Construction Cost
1	Modified Ludzack Ettinger	$24,000,000
2	Sequencing Batch Reactors (SBRs);	$22,500,000

Cost comparisons for the Surfside facility were calculated for Modified Ludzack Ettinger (MLE) process and Sequencing Batch Reactors (SBRS). Costs for these two processes are very similar. The detailed cost comparison is calculated in the Surfside Preliminary Design Report. Trickling filters and Rotating Biological Contactors were not considered because they require chemical addition, which is not consistent with the Town’s goals for minimal use of hazardous chemicals. In addition, both RBCs and Trickling Filters require a downstream process for nitrogen removal.

The cost comparisons for the treatment alternatives for Madaket were based on the Facilities Plan for the Siasconset Wastewater Treatment Facility. The comparisons for the Siasconset Facility detailed that SBRs were the most cost effective alternative. The Town decided to use the same treatment process in Madaket because operation and maintenance costs are cheaper for the Town if the same treatments processes are used.

4. Collection and Transmission Alternatives Costs

Various alternatives were evaluated for addressing the areas of wastewater disposal need in the Town of Nantucket. The three alternatives are: (a) Convention Gravity Sewer with Pumping Stations and Force Mains and connection to the existing system; (b) Low Pressure Sewers with connection to the existing system; and (c) Innovative/Alternative Systems with on-site disposal. An estimated project cost, estimated operation and maintenance cost, and present worth cost was developed for each of these alternatives for the five needs areas (Madaket, Monomoy, Somerset, Shimmo, and Warren's Landing) identified in Phase I. The present worth analysis for the collection and transmission alternatives is based on the cost to both the Town and the individual homeowner.

Madaket Study Area

Alternative No. 1 consists of the installation of approximately 38,150 l.f. of gravity sewers, 16,320 l.f. of force mains and 6 pumping stations. All gravity sewers and force mains would be located in existing roadways while each of the pumping stations would required the purchase of land. The approximate 293,007 gpd of wastewater generated in the Madaket Study Area would be transported and treated at the proposed Madaket Wastewater Treatment Facility.

Alternative No. 2 consists of the installation of approximately 39,930 l.f. of low pressure sewers. All low-pressure sewers would be located within existing roadways. The approximate 293,007 gpd of wastewater generated in the Madaket Study Area would be transported and treated at the proposed Madaket Wastewater Treatment Facility.

Alternative No. 3 consists of the installation of approximately 549 innovative/alternative systems. The approximate 293,007 gpd of wastewater generated in the Madaket Study Area would be treated and disposed locally.

Table 4-5 presents the estimated project cost, operation and maintenance cost and present worth for each of the three alternatives for this study area.

Monomoy Study Area

Alternative No. 1 consists of the installation of approximately 19,830 l.f. of gravity sewers, 9,500 l.f. of force mains and 5 pumping stations. All gravity sewers and force mains would be located in existing roadways while each of the pumping stations would required the purchase of land. The approximate 120,551 gpd of wastewater generated in the Monomoy Study Area would be transported and treated at the proposed Monomoy Wastewater Treatment Facility.

Alternative No. 2 consists of the installation of approximately 19,270 l.f. of low pressure sewers. All low-pressure sewers would be located within existing roadways. The approximate 120,551 gpd of wastewater generated in the Monomoy Study Area would be transported and treated at the proposed Monomoy Wastewater Treatment Facility.

Alternative No. 3 consists of the installation of approximately 227 innovative/alternative systems. The approximate 120,551 gpd of wastewater generated in the Monomoy Study Area would be treated and disposed locally.

Table 4-6 presents the estimated project cost, operation and maintenance cost and present worth for each of the three alternatives for this study area.

TABLE 4-5
TOWN OF NANTUCKET
CWMP/FEIR
MADAKET STUDY AREA ALTERNATIVES
ESTIMATED PROJECT COSTS, OPERATION AND MAINTENANCE COSTS AND PRESENT WORTH COSTS

Alternative Number	Description	Quantity	Unit	Unit Price	Extended Total	Estimated Project Cost	Estimated O&M Cost	Present Worth Cost
1	Gravity Sewers							
	Gravity Sewer	38,150	L.F	$275	$10,491,250			
	Pumping Station	6	Each	$750,000	$4,500,000			
	Force Main	16,320	L.F	$200	$3,264,000			
	Land Acquisition	6	Each	$125,000	$750,000	$19,005,250	$189,200	$21,009,635
2	Low Pressure Sewer							
	Low Pressure Sewer	39,930	L.F	$175	$6,987,750			
	Grinder Pumps and Appurtenances	549	Each	$10,000	$5,490,000	$12,477,750	$278,281	$15,425,862
3	Innovative/Alternative	549	Each	$50,000	$27,450,000	$27,450,000	$631,350	$34,138,522

TABLE 4-6
TOWN OF NANTUCKET
CWMP/FEIR
MONOMOY STUDY AREA ALTERNATIVES
ESTIMATED PROJECT COSTS, OPERATION AND MAINTENANCE COSTS AND PRESENT WORTH COSTS

Alternative Number	Description	Quantity	Unit	Unit Price	Extended Total	Estimated Project Cost	Estimated O&M Cost	Present Worth Cost
1	Gravity Sewers							
	Gravity Sewer	19,830	L.F	$275	$5,453,250			
	Pumping Station	5	Each	$750,000	$3,750,000			
	Force Main	9,500	L.F	$200	$1,900,000			
	Land Acquisition	5	Each	$125,000	$625,000	$11,728,250	$167,200	$13,499,567
2	Low Pressure Sewer							
	Low Pressure Sewer	19,270	L.F	$175	$3,372,250			
	Grinder Pumps and Appurtenances	227	Each	$10,000	$2,270,000	$5,642,250	$115,325	$6,864,001
3	Innovative/Alternative	227	Each	$50,000	$11,350,000	$11,350,000	$261,050	$14,115,564

Somerset Study Area

Alternative No. 1 consists of the installation of approximately 19,970 l.f. of gravity sewers, 7,115 l.f. of force mains and 3 pumping stations. All gravity sewers and force mains would be located in existing roadways while each of the pumping stations would required the purchase of land. The approximate 108,794 gpd of wastewater generated in the Somerset Study Area would be transported and treated at the proposed Somerset Wastewater Treatment Facility.

Alternative No. 2 consists of the installation of approximately 19,970 l.f. of low pressure sewers. All low-pressure sewers would be located within existing roadways. The approximate 108,794 gpd of wastewater generated in the Somerset Study Area would be transported and treated at the proposed Somerset Wastewater Treatment Facility.

Alternative No. 3 consists of the installation of approximately 205 innovative/alternative systems. The approximate 108,794 gpd of wastewater generated in the Somerset Study Area would be treated and disposed locally.

Table 4-7 presents the estimated project cost, operation and maintenance cost and present worth for each of the three alternatives for this study area.

**TABLE 4-7
TOWN OF NANTUCKET
CWMP/FEIR
SOMERSET STUDY AREA ALTERNATIVES
ESTIMATED PROJECT COSTS, OPERATION AND
MAINTENANCE COSTS AND PRESENT WORTH COSTS**

Alternative Number	Description	Quantity	Unit	Unit Price	Extended Total	Estimated Project Cost	Estimated O&M Cost	Present Worth Cost
1	Gravity Sewers							
	Gravity Sewer	19,970	L.F	$275	$5,491,750			
	Pumping Station	3	Each	$750,000	$2,250,000			
	Force Main	7,115	L.F	$200	$1,423,000			
	Land Acquisition	3	Each	$125,000	$375,000	$9,539,750	$123,200	$10,844,931
2	Low Pressure Sewer							
	Low Pressure Sewer	19,970	L.F	$175	$3,494,750			
	Grinder Pumps and Appurtenances	205	Each	$10,000	$2,050,000	$5,544,750	$104,391	$6,650,669
3	Innovative/Alternative	205	Each	$50,000	$10,250,000	$10,250,000	$235,750	$12,747,536

Shimmo Study Area

Alternative No. 1 consists of the installation of approximately 26,315 l.f. of gravity sewers, 5,000 l.f. of force mains and 5 pumping stations. All gravity sewers and force mains would be located in existing roadways while each of the pumping stations would required the purchase of land. The approximate 98,675 gpd of wastewater generated in the Shimmo Study Area would be transported and treated at the proposed Shimmo Wastewater Treatment Facility.

Alternative No. 2 consists of the installation of approximately 26,315 l.f. of low pressure sewers. All low-pressure sewers would be located within existing roadways. The approximate 98,675 gpd of wastewater generated in the Shimmo Study Area would be transported and treated at the proposed Shimmo Wastewater Treatment Facility.

Alternative No. 3 consists of the installation of approximately 185 innovative/alternative systems. The approximate 98,675 gpd of wastewater generated in the Shimmo Study Area would be treated and disposed locally.

Table 4-8 presents the estimated project cost, operation and maintenance cost and present worth for each of the three alternatives for this study area.

TABLE 4-8
TOWN OF NANTUCKET
CWMP/FEIR
SHIMMO STUDY AREA ALTERNATIVES
ESTIMATED PROJECT COSTS, OPERATION AND MAINTENANCE COSTS AND PRESENT WORTH COSTS

Alternative Number	Description	Quantity	Unit	Unit Price	Extended Total	Estimated Project Cost	Estimated O&M Cost	Present Worth Cost
1	Gravity Sewers							
	Gravity Sewer	26,315	L.F	$275	$7,236,625			
	Pumping Station	5	Each	$750,000	$3,750,000			
	Force Main	5,000	L.F	$200	$1,000,000			
	Land Acquisition	5	Each	$125,000	$625,000	$12,611,625	$167,200	$14,382,942
2	Low Pressure Sewer							
	Low Pressure Sewer	26,315	L.F	$175	$4,605,125			
	Grinder Pumps and Appurtenances	185	Each	$10,000	$1,850,000	$6,455,125	$94,992	$7,461,470
3	Innovative/Alternative	185	Each	$50,000	$9,250,000	$9,250,000	$212,750	$11,503,874

Warren's Landing Study Area

Alternative No. 1 consists of the installation of approximately 7,400 l.f. of gravity sewers, 3,925 l.f. of force mains and 2 pumping stations. All gravity sewers and force mains would be located in existing roadways while each of the pumping stations would required the purchase of land. The approximate 47,562 gpd of wastewater generated in the Warren's Landing Study Area would be transported and treated at the proposed Warren's Landing Wastewater Treatment Facility.

Alternative No. 2 consists of the installation of approximately 8,000 l.f. of low pressure sewers. All low-pressure sewers would be located within existing roadways. The approximate 47,562 gpd of wastewater generated in the Warren's Landing Study Area would be transported and treated at the proposed Warren's Landing Wastewater Treatment Facility.

Alternative No. 3 consists of the installation of approximately 89 innovative/alternative systems. The approximate 47,562 gpd of wastewater generated in the Warren's Landing Study Area would be treated and disposed locally.

Table 4-9 presents the estimated project cost, operation and maintenance cost and present worth for each of the three alternatives for this study area.

TABLE 4-9
TOWN OF NANTUCKET
CWMP/FEIR
WARREN'S LANDING STUDY AREA ALTERNATIVES
ESTIMATED PROJECT COSTS, OPERATION AND MAINTENANCE COSTS AND PRESENT WORTH COSTS

Alternative Number	Description	Quantity	Unit	Unit Price	Extended Total	Estimated Project Cost	Estimated O&M Cost	Present Worth Cost
1	Gravity Sewers							
	Gravity Sewer	7,400	L.F	$275	$2,035,000			
	Pumping Station	2	Each	$750,000	$1,500,000			
	Force Main	3,925	L.F	$200	$785,000			
	Land Acquisition	2	Each	$125,000	$250,000	$4,570,000	$101,200	$5,642,113
2	Low Pressure Sewer							
	Low Pressure Sewer	8,000	L.F	$175	$1,400,000			
	Grinder Pumps and Appurtenances	89	Each	$10,000	$890,000	$2,290,000	$45,258	$2,769,459
3	Innovative/Alternative	89	Each	$50,000	$4,450,000	$4,450,000	$102,350	$5,534,296

5. Recommendations Based on Evaluation of Cost

The evaluation of costs indicates that the best alternative for wastewater disposal problems for each of the Study Areas is the installation of a Low Pressure Sewer System and to use Sequencing Batch Reactors for the Expansion of the Surfside WWTF Expansion and new Madaket WWTF.

C. INSTITUTIONAL ARRANGEMENTS

1. General

The Town of Nantucket Department of Public Works is presently governed by its Board of Selectmen. The Town presently owns and operates two municipal sewer systems, one that currently collects, treats and disposes of wastewater at the Surfside Wastewater Treatment Facility and another smaller collection system located in Siasconset. At present, the Siasconset WWTF is undergoing a major upgrade with the design and construction of a state of the art wastewater treatment facility to provide Class I discharge standards as required by Federal and State law. The Town has completed a Preliminary Design Report to upgrade and expand its Surfside Wastewater Treatment Facility to Class I discharge standards as required by Federal and State law. All areas presently not connected to either of these two systems rely on individual on-site wastewater disposal systems, which are under the jurisdiction of the local Board of Health under state Title 5 rules and regulations at "310 CMR 15.000 - The State Environmental Code, Title 5: Standard Requirements for the Siting, Construction, Inspection, Upgrade and Expansion of On-Site Sewage Treatment and Disposal Systems and for the Transport and Disposal of Septage, Effective 3/31/95." Historically the Town of Nantucket Board of Health has adopted requirements for design and construction of on-site systems that augmented the state requirements.

In early 1997, the Town of Nantucket retained Earth Tech, Inc. to prepare a Facilities Plan for Wastewater Disposal and Treatment for the Village of Siasconset. The report entitled "Siasconset Facilities Plan for Wastewater Treatment and Disposal," Nantucket Massachusetts, dated December 31, 1997, (Siasconset Facilities Plan) detailed a solution for the Siasconset Wastewater Infiltration Beds and the lack of wastewater treatment achieved by the infiltration beds. The facilities plan report met the requirements of the Administrative Consent Order between the Town of Nantucket and the Department of Environmental Protection.

In early 1998, the Town of Nantucket retained Earth Tech, Inc. to prepare an Island-wide Comprehensive Wastewater Management Plan/Environmental Impact Report (CWMP/EIR). In general, the objective of a CWMP/EIR is to identify areas within the Town with subsurface wastewater disposal problems and to develop a plan to mitigate or eliminate the problems. The wastewater treatment solutions presented in the Siasconset Facilities Plan are considered in this CWMP/EIR.

The Town of Nantucket established a special procedure for review of this major and complicated project. The special procedure consists of a three phase review of the CWMP/EIR Document. The Document has been delineated into three phases, where the scope of future phases is based in part on the results of the preceding phase. The first phase, Phase I, included the Needs Analysis. The Phase II Report contained the Alternatives and Site Identification and Draft Environmental Impact Report (DEIR) and in this Phase III includes the Final Environmental Impact Report (FEIR). The scope of the Island-wide CWMP/EIR is twofold: (1) to determine the areas on the Island with wastewater disposal problems that cannot be solved with a conventional Title 5 wastewater disposal system; and (2) evaluate and make recommendations on the most viable solution for wastewater disposal in each study area based on environmental, technical, and economic considerations. With the filing of this Phase III Report, all of these scope items have been determined and a recommended plan has been established.

The currently recommended plan for new and expanded wastewater collection, transmission and treatment facilities have been evaluated, and are proposed to be designed and constructed under the guidance and direction of the Town of Nantucket Department of Public Works and Board of Selectmen.

In order to manage and operate the proposed wastewater collection, transmission and treatment facilities, the Town will need to implement institutional and system management procedures, which are briefly described in the following paragraphs.

2. Institutional and System Management Procedures

Establishment of Sewer and Septic Overlay Districts

In order to legally identify the boundaries of and set policy relating to, sewer and septic overlays need to be delineated. This will allow the Town to distinguish which properties have the right to hook into the municipal sewers system and, also, those that will be managed under the Town's Septage Management Program. This will involve acceptance at the Town's level. The primary purposes of the establishment of "Sewer Districts" are to preserve the existing wastewater infrastructure capacity for the residents/businesses located adjacent to the existing collection system and for residents/businesses located within the areas of wastewater disposal need as identified in the CWMP/EIR Document.

Review of the Current Sewer Use Rules and Regulations

A thorough review of the current Sewer Use Rules and Regulations needs to be completed in order to set the minimum requirements for all users of the Town's wastewater collection, transmission and treatment facilities. This will enable the Town to continue to comply with all applicable state and federal laws as well as the requirements of the receiving treatment facilities. Included in these regulations will be the provisions for sewer connections and extensions, building sewers, infiltration/inflow, construction requirements, regulation of wastewater discharges, pretreatment of industrial wastewater, permit applications and issuance, reporting requirements, compliance monitoring, enforcement proceedings, service charges and fees. The main purpose of these regulations is to prevent the introduction of undesirable pollutants and to provide standard requirements for all users discharging into the sewer system. These regulations must be in accordance with those of the receiving treatment facilities accepting Nantucket's wastewater. The rules and regulations will be administered by the Director of Public Works.

Cost Recovery Plan

Cost Recovery Program will need to be developed in order to recover the capital costs of new and expanded wastewater collection, transmission and treatment facilities. Nantucket will need to address the problem of how to equitably apportion the capital costs among its system's users. The cost recovery for the planning, design, construction and implementation of Nantucket's wastewater facilities and the cost(s) of capital outlay could potentially be by a combination of property taxes and betterments. An equitable means of recovering these costs could be: to recover the cost of any portion of the project that provides a general benefit to the entire community through municipal property taxes; and to recover the cost of public improvements which are of specific benefit to a particular area in the community by betterments. Nantucket must arrive at a financing solution that is fair, equitable and politically acceptable. A cost recovery plan will be formulated, reviewed, and adopted by the Town prior to the start of construction of the Project.

Review of Current Sewer User Charge System

A review of the current sewer user charge system will need to be completed and, reviewed and any changes adopted by the Town which meets the requirements of the state regulations in order to recover the costs required to operate, maintain and replace the wastewater collection, transmission and treatment facilities. In the Fall of 2003, the Town of Nantucket completed a Sewer Rate Study. A copy of the study can be found in Appendix I.

Sewer System Expansion Control Policy

A Sewer System Expansion Control Policy will need to be developed and adopted by the Board of Selectmen that deals with issues concerning the expansion of the sewer collection system outside of the finalized "Needs Areas" approved in the CWMP/EIR. The expansion of the sewer service areas within Town will need to be controlled in order for the Town to stay within its allotted flow allowances at the receiving wastewater treatment facilities. This policy should address issues such as:

- The number of service connections allotted to large parcels of undeveloped land that have frontage on a sewer line in a designated area;
- Connections to force mains;
- Sewer service to back lots which do not have frontage on a street that has sewers;
- The possibility of establishments not in a designated sewer service area connecting into a gravity main that services a designated sewer area;
- Sewer system extension outside the "Needs Areas" as identified and approved in the CWMP/EIR;
- Title 5 failures outside of the designated sewer areas;
- Policy to service the first floor of a structure by gravity and exceptions to this rule;
- Connections to interceptors outside of the designated service area; and
- Establishment of "Low Flow Sewer Systems".

This policy should address the above issues and, when implemented, will prioritize the concerns for the Town to include in any future expansion plans for the sewer system if there is adequate capacities remaining within their wastewater flow allowances at the receiving wastewater treatment facilities.

Review of Sewerage System Staffing and Operations Plan

A review of the current and projected Sewerage System Staffing and Operations Plan will need to be completed. It is recommended that this plan be developed during the design phases of the proposed Surfside WWTF upgrade and Madaket WWTF. This plan will review and estimate the current and proposed tasks, responsibilities and staffing requirements for each aspect of the operation and maintenance of the current and proposed wastewater collection, transmission and treatment facilities. The relative merits to Town staff versus contract operations should be evaluated.

Review of Current System Construction Standards

In order to maintain consistency Island-wide, there should be a review and discussion on construction standards for the Town. Included in this review would be facility design (for spare part redundancy and general O & M) and manhole design.

Septage Management Plan

Proactive in its approach to the CWMP/EIR, the Town of Nantucket began the process of developing a Septage Management Plan for the areas of Town not included in the current and proposed municipal sewer service area. The goal of this Septage Management Plan (SMP) is to protect and maintain public health, ensure protection of surface and groundwater quality, provide sustainability of the Island's single-source aquifer, maintain water resources as recreational, aesthetic and economic assets, improve the environment and prevent its deterioration, preserve and retain local control of on-site wastewater disposal systems without regulatory intervention and to protect private investments with regards to residential property values that is not only accepted locally but in accordance with all regulatory requirements. The successful long-term sustainability of on-site wastewater disposal systems is dependent on proper operation and maintenance in order to prevent adverse health and environmental impacts. It is the intent of this SMP to operate in conjunction with the Town's municipal wastewater collection systems in the proper collection and disposal of septage on Nantucket.

The Town has reviewed the form of government to regulate and oversee the Septage Management Plan and has elected to have the current Board of Health administer the institutional requirements set forth in the final approved SMP that is now being evaluated.

Water Conservation Program

It is recommended that an overall water conservation program be implemented in order to reduce the amount of water consumed and discharged into both the existing on-site wastewater disposal systems and the proposed wastewater collection, transmission and treatment facilities. The Town will be limited as to how much wastewater it can send to the receiving wastewater treatment facilities. Not only will the implementation of water conservation devices and programs result in lower operational costs to each user, but it will also result in reserve capacity at the receiving treatment facilities should future areas of Need arise in Town. This is presently being undertaken by the Wannacomet Water Company. It is recommended that the Department of Public Works, in conjunction with the Water Company work to promote a public education program in order to achieve maximum benefit.

D. RESIDUALS DISPOSAL

The Town leases the property for the Municipal Compost facility. A private contractor operates the facility. According to the facility operator, the composting facility can handle the proposed additional residuals disposal. The recommended plan is to continue this operation. No other alternatives were reviewed because this alternative is already established and permitted.

E. LOCATION OF FACILITIES

1. Madaket WWTF – FAA Site

The Madaket WWTF is proposed to be located on the current FAA site. The WWTF will be at least 1,000 feet away from residential areas and located outside of any environmentally sensitive areas. This will minimize any potential aesthetic issues with the facility.

The hydrogeological study for the FAA site will serve to help situate the disposal beds on this site in the area of least consequence. In addition, the wastewater effluent is proposed be treated to a much higher degree than the current Title 5 systems in this area. This will help minimize any impacts to Long Pond or Madaket Harbor. The hydrogeological report for this site is included in Appendix F.

The WWTF will be designed to meet the guidelines of the Nantucket Historic District Commission (NHDC) as detailed in, "Building with Nantucket in Mind." The guidelines detail strict design requirements, such as building color, building outline, and the use of native species in landscaping. The final design will be reviewed by the NHDC during their building permit process.

2. Surfside WWTF Upgrade and Expansion

The proposed Surfside WWTF project will be an upgrade from primary to secondary treatment as required in ACO NO. ACOP-BO-03-1G002 and an expansion of the existing facility. Since the site has been previously disturbed and is currently used and permitted for wastewater treatment, the project will have minimal effect on the area. The hydrogeological report is included in Appendix E and the ACO is included in Appendix A.

The design will be similar to the existing facility and will be designed to meet the guidelines of the Nantucket Historic District Commission (NHDC) as detailed in, "Building with Nantucket in Mind." The guidelines detail strict design requirements, such as building color, building outline, and the use of native species in landscaping. The final design will be reviewed by NHDC during their building permit process.

3. Needs Areas

Madaket, Monomoy, Somerset, Shimmo, and Warren's Landing Study Areas are recommended to receive sewer expansion. The sewer lines will be constructed in existing roadways. This will minimize aesthetic problems. No new pumping stations in these areas are proposed.

This new infrastructure will be located outside of environmentally sensitive areas, since it is proposed to be located primarily in previously disturbed locations. Removing theses areas from failing Title 5 systems and connecting them to a municipal sewer system will serve to remove many pollutants from the Nantucket and Madaket Harbors and other local water bodies.

G. PHASED CONSTRUCTION

A phased construction will be used for the construction of the selected alternative. A phased construction will allow the Town to spread out the cost of design, construction, and implementation of the selected alternative through several fiscal years. In addition, the selected capital improvement will be reviewed with the Town departments and committees, such as the Department of Public Works, Board of Selectmen and Finance Committee to determine the financial impacts of the recommended plans along with any other improvement projects such as roadway improvements and school. The Town is also in the process of determining the financing methods necessary to implement the recommendations detailed herein.

At this time, the Town has determined that the highest priority is to continue investigation of infiltration/inflow within the existing collection system, begin rehabilitation of the existing infrastructure located within the Brant Point Area, and to begin the design phase for the upgrade and expand the existing Surfside WWTF from primary to secondary treatment as required in ACO. The Town has included warrant articles for these three projects for action at the Spring 2004 Town Meeting. Over the next few months, the Town will be developing the remaining financial options best suited for the Town to implement the remaining recommendations contained in this Document.

In addition, since the CWMP/EIR is a long-term planning document, the Town has the opportunity to incorporate any additional information that is developed by Federal, State and/or Local authorities and/or private entities prior to the implementation of the recommendations and adjust the phased construction, if appropriate

H. FLEXIBILITY AND RELIABILITY

The wastewater treatment alternatives will be design to be flexible and reliable so that any unforeseen circumstances can be dealt with in a timely manner. All infrastructure and wastewater treatment will be designed in accordance with the New England Interstate Water Pollution Control Commission's "Guide for the Design of Wastewater Treatment Works." The guide details how to number and arrange units so that the componet parts of plants are arranged for the greatest operating convenience, flexibility, and economy and for the installation of future units. The design and layout of the treatment facilities will include provisions for future expansion or future upgrades.

The facilities will be designed and constructed with the following project goals in mind that have been identified by the Town: (1) Use the Existing Surfside WWTF Site; (2) Use the Existing FAA property; (3) Low Maintenance; (4) Operate without the Use or with a Limited Use of Chemicals; (5) Capture and Treat Odors; (6) Meet High Discharge Limits; and (6) Ensure Community Acceptance.

In addition, the facilities will be similarly designed so that the operation and maintenance of the facilities on the Island will be standardized. All three of the wastewater treatment facilities on the Island will utilize SBRs and be standardized on other unit processes, such as pumping equipment. The standardized design will maximize efficiency and the ability to minimize the impacts from unforeseen equipment problems.

I. IMPLEMENTATION CAPABILITY

Each of the recommended alternatives will be reviewed by the applicable federal, state and local governmental units for ability to implement via appropriate permitting agencies. As part of the MEPA process, Nantucket is required to provide the Secretary of Environmental Affairs and the public with a 30-day public review period, during which comments are solicited by the Secretary, reviewed and applied appropriately in the MEPA Certificate. In addition to the MEPA process, all of the plans and specifications for this project will be reviewed by the Department of Environmental Protection and will be subject to all required permitting regulations.

The Town of Nantucket is prepared to bear its local share of the cost of the selected alternatives through local appropriations, Town Meeting action, and through the user tax base. Currently the Town has one WWTF in operation and one WWTF under construction both of which fall under the Department of Public Works jurisdiction. Other recommended institutional arrangements are discussed in this Document and the Town has indicated will be in place before any plan is implemented.

J. REGULATORY, DESIGN AND RELIABILITY REQUIREMENTS

As part of the MEPA process, Nantucket is required to file an EIR. The Secretary issued a Certificate containing a scope that provides a description of alternatives to be considered in the EIR, environmental impacts to be analyzed, and techniques to be used in the analysis. EIRs are subject to 30 days of agency and public comment after publication in the Environmental Monitor. This project is also subject to the rules and regulations of the State Revolving Fund (SRF). Plans and Specifications will be reviewed and approved by the Department of Environmental Protection and the project will be evaluated and subject to all required permitting regulations.

All of the recommended plans in this Document have been formally approved on the federal, state and local level. This plan will not implement any new technologies that have not already been approved by MEPA and the SRF program. The Town of Nantucket has worked closely with the DEP and MEPA in this process.

Section 5.0

Recommended Plan

5.0 RECOMMENDED PLAN

A. DETAILED RECOMMENDED PLAN

1. Introduction

In previous sections of this Report, each Study Area determined by the Phase I Report to be a "Needs Area" or an area unsustainable with current on-site wastewater disposal systems, was looked at in terms of possible solutions for wastewater need. This section of the Report highlights the recommended plan for each Study Area as well as associated institutional impacts, environmental impacts, capital costs, and operation and maintenance costs.

2. Study Areas

In Phase I of the CWMP, the Island was delineated into eighteen (18) Study Areas based on geographic location. All of these areas were analyzed for the need for wastewater disposal beyond the use of Conventional Title 5 on-site wastewater disposal systems. Once an area was determined to be a Needs Area, several alternatives were analyzed in order to determine a solution for each area's needs. The four options analyzed for each area were: (1) Conventional Gravity Sewers with Pump Stations and Forcemains; (2) Low Pressure Sewers; (3) I/A systems; and (4) On-Site Wastewater Disposal Systems with the implementation of a Septage Management Plan (SMP).

Each Needs Area was first evaluated for the possibility of connecting to an existing collection system to be treated at either the Siasconset Wastewater Treatment Facility or the Surfside Wastewater Treatment Facility. This was not a feasible option for Madaket, Warren's Landing, Polpis, Pocomo, Wauwinet, and Quidnet due to their distance from either Wastewater Treatment Facility (WWTF). The costs incurred with attempting to tie these areas into existing facilities due to the length of pipe needed to connect these areas as well as operation and maintenance costs would be prohibitive.

The next alternative evaluated was the construction of a local treatment facility or communal/cluster treatment for each Need Area Land availability or lack thereof, and the abundance of wetlands, harbor watersheds proximity, and other water bodies posed as major obstacles on the Island and therefore became difficult scenarios for numerous Needs Areas. Constructing a local treatment facility, combined with ground water discharge of treated effluent necessitates acres of land, which combined with the above mentioned water and wetland issues, eliminated this option in many areas on Island. With the development of a SMP to be implemented by the Town, on-site Conventional Title 5 wastewater disposal systems became a sensible solution for those areas on Island that lack sufficient and suitable land area and where other alternatives became cost-prohibitive. The following is a discussion of each Study Area and the recommended plan based on the afore-mentioned criteria.

Study Area 1 – Madaket

The Madaket Study Area was evaluated in the Phase I Report as long-term unsustainable with the current on-site wastewater disposal systems or simply a "Needs Area". Out of the four options evaluated in the Phase III Report as a solution for this Needs Area, the most feasible is Option No. 2, Low Pressure Sewers.

The recommended plan consists of the installation of 39,930 linear feet of low-pressure sewer with sizes ranging from 1-1/4 to 4 inch diameter pipe. Approximately 1,400 linear feet of the total 39,930 linear feet will be used for connection to a future satellite wastewater treatment facility. All low-pressure sewers will be located in the roadways and end at the new satellite wastewater treatment plant in-plant pump station. Refer to Figure 5-1 for the proposed Madaket Collection System.

A parcel located in close proximity to the Madaket Study Area will be able to accommodate the collection, treatment and disposal of wastewater for this Area making this the most feasible option. The Federal Aviation Administration currently owns the parcel where the new Madaket Wastewater Treatment facility is proposed to be located and is in the process of surplusing the property through the General Services Administration. Nantucket has begun the legal process through required channels in order to acquire the property.

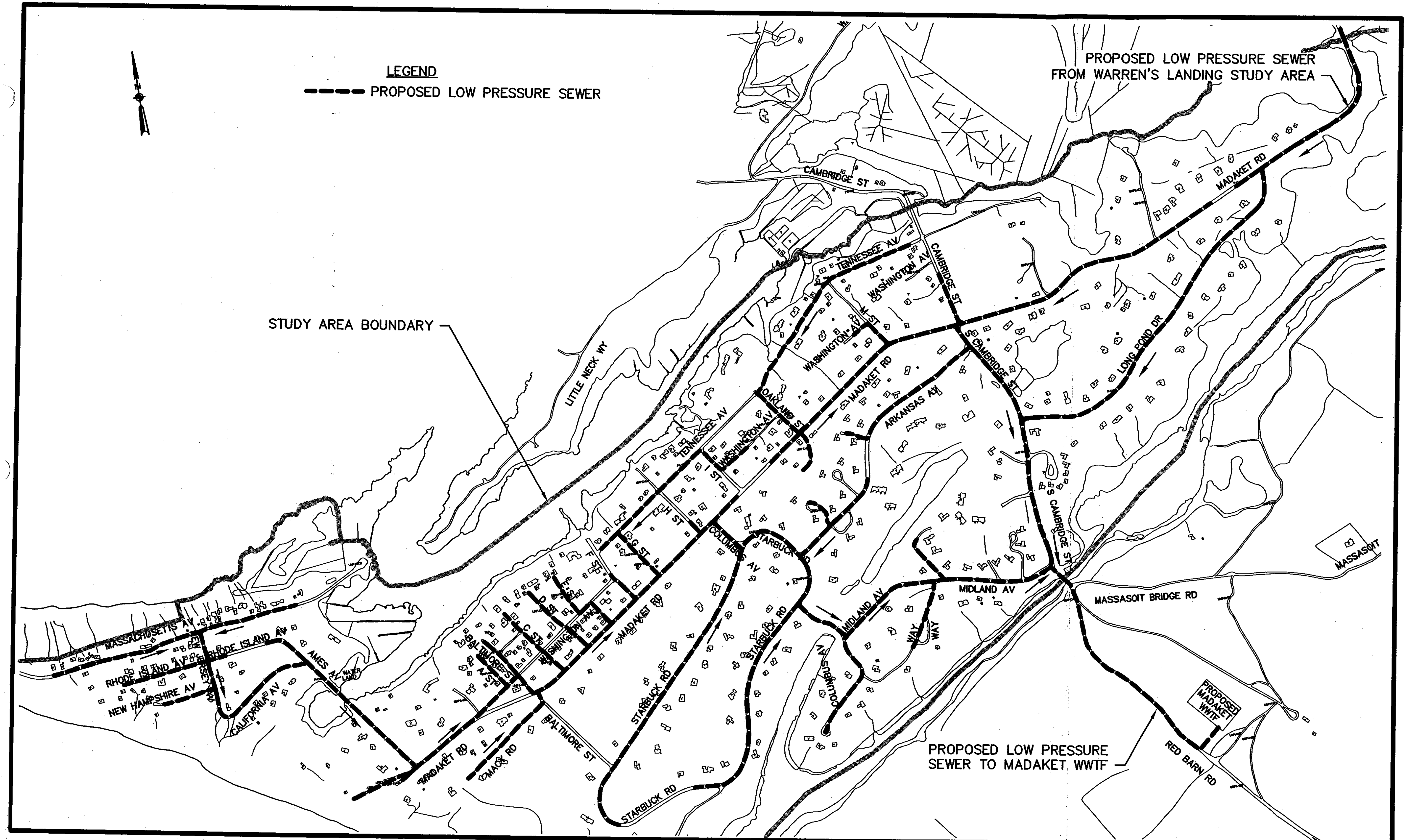


FIGURE 5–1
TOWN OF NANTUCKET
CWMP/FEIR
MADAKET STUDY AREA
NOT TO SCALE

EARTH TECH

Study Area 2 – Warren's Landing

The Warren's Landing Study Area was evaluated in the Phase I Report as long-term unsustainable with the current on-site wastewater disposal systems or simply a "Needs Area". Out of the four options evaluated in the Phase III Report as a solution for this Needs Area, the most feasible is Option No. 2, Low Pressure Sewers.

The recommended plan consists of installation of 8,000 linear feet of low-pressure sewer with sizes ranging from 1-1/4 to 4 inch diameter pipe. All low-pressure sewers will be located in the roadways and connected to the Madaket collection system via Madaket Road. Refer to Figure 5-2 for the proposed Warren's Landing Collection System. A parcel located in close proximity to the Madaket Study Area will be able to accommodate the collection, treatment and disposal of wastewater for the Warren's Landing Study Area, making this the most feasible option. The Federal Aviation Administration currently owns the parcel where the new Madaket Wastewater Treatment facility is proposed to be located and is in the process of surplusing the property through the General Services Administration. Nantucket has begun the legal process through required channels in order to acquire the property.

Study Area 3 – Cisco

The Cisco Study Area was evaluated in the Phase I Report as long-term sustainable with the current on-site wastewater disposal systems. Therefore, the recommended plan is Option No. 4, continued use of on-site wastewater disposal systems with oversight from the Town under a Septage Management Plan.

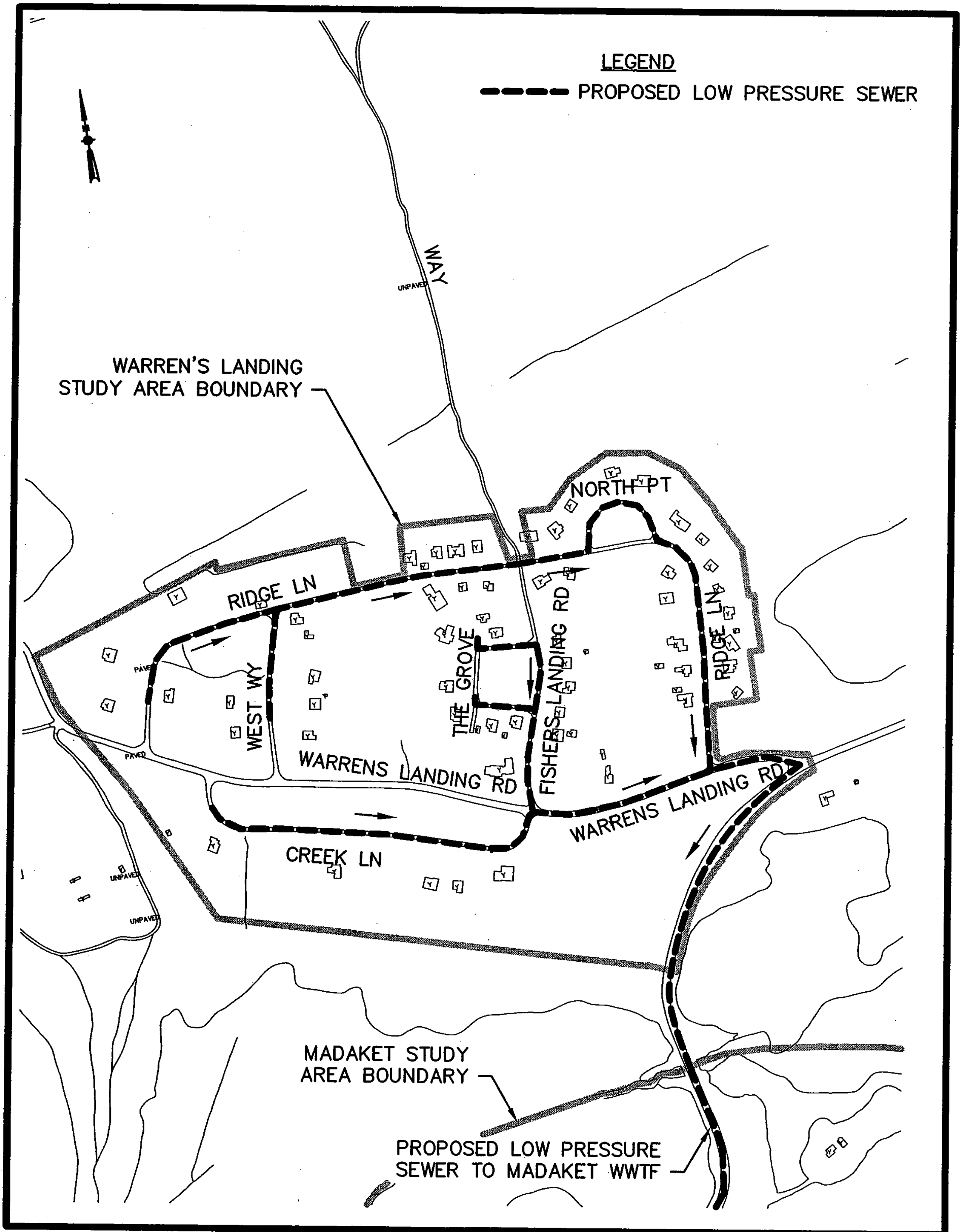


FIGURE 5-2
TOWN OF NANTUCKET
CWMP/FEIR
WARREN'S LANDING STUDY AREA

EARTH TECH

NOT TO SCALE

Study Area 4 – Somerset

The Somerset Study Area was evaluated in the Phase I Report as long-term unsustainable with the current on-site wastewater disposal systems or simply a "Needs Area". Out of the four options evaluated in the Phase III Report as a solution for this Needs Area, the most feasible is a combination of Option No. 1, Conventional Gravity Sewers and Option No. 2, Low Pressure Sewers.

The recommended plan consists of the installation of 12,850 linear feet of gravity sewer with sizes ranging from 4 to 8 inch diameter pipe and 7,115 linear feet of low-pressure sewer. Refer to Figure 5-3 for the proposed Somerset Collection System.

Of the 12,850 linear feet of gravity sewer, 1,000 linear feet will be used to connect to the Town's existing gravity sewer via Bartlett Road to Surfside Road, which will convey the wastewater to the Sea Street Pump Station located in the Town Area of Nantucket. The Sea Street Pump Station will pump the wastewater flow to the Surfside Wastewater Treatment Facility for treatment and disposal. All sewers will be located in the roadways.

Study Area 5 – Miacomet

The Miacomet Study Area was evaluated in the Phase I Report as long-term sustainable with the current on-site wastewater disposal systems. Therefore, the recommended plan is Option No. 4, continued use of on-site wastewater disposal systems with oversight from the Town under a Septage Management Plan.

Study Area 6 – Surfside

The Surfside Study Area was evaluated in the Phase I Report as long-term sustainable with the current on-site wastewater disposal systems. Therefore, the recommended plan is Option No. 4, continued use of on-site wastewater disposal systems with oversight from the Town under a Septage Management Plan.

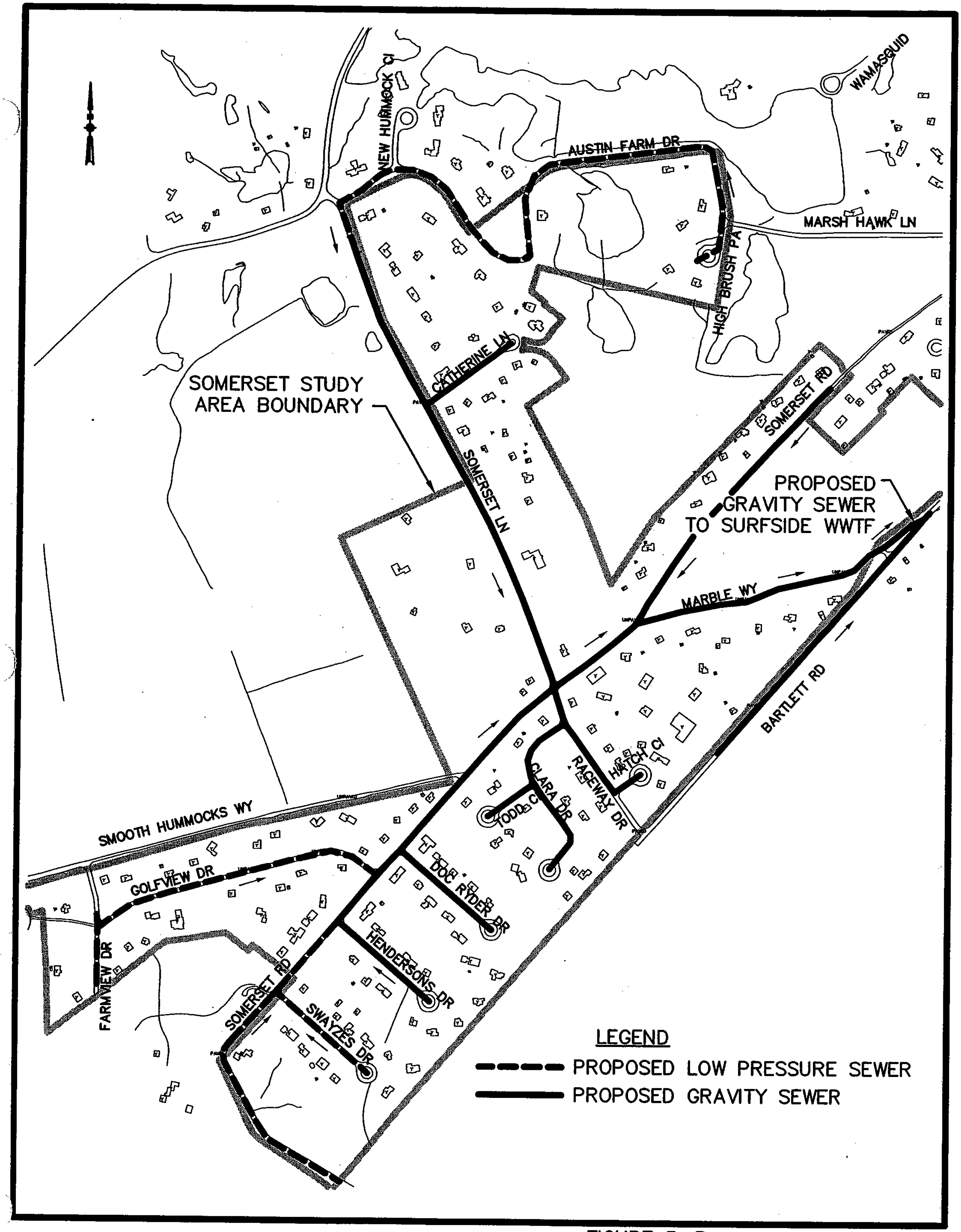


FIGURE 5-3
TOWN OF NANTUCKET
CWMP/FEIR
SOMERSET STUDY AREA

NOT TO SCALE

EARTH TECH

Study Area 7 – Tom Nevers – Low Density

The Tom Nevers-Low Density Study Area was evaluated in the Phase I Report as long-term sustainable with the current on-site wastewater disposal systems. Therefore, the recommended plan is Option No. 4, continued use of on-site wastewater disposal systems with oversight from the Town under a Septage Management Plan.

Study Area 7H – Tom Nevers-High Density

The Tom Nevers-High Density Study Area was evaluated in the Phase I Report as long-term sustainable with the current on-site wastewater disposal systems. Therefore, the recommended plan is Option No. 4, continued use of on-site wastewater disposal systems with oversight from the Town under a Septage Management Plan.

Study Area 8 – Siasconset

The Siasconset Study Area was evaluated in the Phase I Report as long-term unsustainable with the current on-site wastewater disposal systems or simply a "Needs Area". However, the Siasconset Study Area is currently being addressed with the design and construction of the Siasconset Wastewater Treatment Facility due to be completed with construction in spring of 2004. The facility is located in the Siasconset area on United States Coastguard property. The Town is currently considering the establishment of this Study Area as a "Sewer District".

Study Area 9 – Quidnet

The Quidnet Study Area was evaluated in the Phase I Report as long-term unsustainable with the current on-site wastewater disposal systems or simply a "Needs Area". The Quidnet Area is a high priority in terms of requiring attention due its location in proximity to and potential impact to Sesachacha Pond from the high number of failing on site wastewater disposal systems. Sesachacha Pond is currently listed on the State's 303(d) list for having high Nitrogen levels.

However, due to the work being completed in this area by the Massachusetts Estuaries Project (MEP), the recommended plan under Option No. 4, consists of maintaining the current on-site wastewater disposal systems until the MEP is completed and efforts at solutions can be coordinated. The Town, under the auspices of the Septage Management Plan, will monitor all on-site wastewater disposal systems and at the completion of the MEP, will be reevaluated for a long-term wastewater solution in accordance with the guidelines of the MEP. Refer to the Executive Summary for an explanation of the MEP.

Study Area 10 – Wauwinet

The Wauwinet Area was evaluated in the Phase I Report as long-term unsustainable with the current on-site wastewater disposal systems or simply a “Needs Area”. The Wauwinet Area is a high priority in terms of requiring attention due its location in proximity to and potential impact to Nantucket Harbor from the on site wastewater disposal systems.

However, due to the work being completed in this area by the Massachusetts Estuaries Program (MEP), the recommended plan, under Option No. 4, consists of maintaining the current on-site wastewater disposal systems until the MEP is completed and efforts at solutions can be coordinated. The Town, under the auspices of the Septage Management Plan, will monitor all on-site wastewater disposal systems and at the completion of the MEP, will be reevaluated for a long-term wastewater solution in accordance with the guidelines of the MEP. Refer to the Executive Summary for an explanation of the MEP.

Study Area 11 – Pocomo

The Pocomo Study Area was evaluated in the Phase I Report and determined to be a Needs Area based on the Area’s proximity to and potential impact to the Nantucket Harbor Watershed.

However, the recommended plan for the Pocomo Study Area, under Option No. 4, consists of maintaining on-site wastewater disposal systems until the MEP is completed and efforts at solutions can be coordinated.. The Town, under the auspices of the Septage Management Plan, will monitor all on-site wastewater disposal systems and at the completion of the MEP, will be reevaluated for a long-term wastewater solution in accordance with the guidelines of the MEP. Refer to the Executive Summary for an explanation of the MEP.

Study Area 12 – Polpis

The Polpis Study Area was evaluated in the Phase I Report as long-term unsustainable with the current on-site wastewater disposal systems or simply a "Needs Area". The Polpis Study Area is a high priority in terms of requiring attention due its location in proximity to and potential impact to Nantucket Harbor from the on site wastewater disposal systems.

However, due to the work being completed in this area by the Massachusetts Estuaries Program (MEP), the recommended plan, under Option No. 4, consists of maintaining the current on-site wastewater disposal systems until the MEP is completed and efforts at solutions can be coordinated. The Town, under the auspices of the Septage Management Plan, will monitor all on-site wastewater disposal systems and at the completion of the MEP, will be reevaluated for a long-term wastewater solution in accordance with the guidelines of the MEP. Refer to the Executive Summary for an explanation of the MEP.

Study Area 13 – Town

The Town was evaluated in the Phase I Report as long-term unsustainable with the current on-site wastewater disposal systems or simply a "Needs Area". This was due not only to its proximity in relation to the Nantucket Harbor Watershed delineation, but, also, based on qualifying criteria as detailed in the Phase I Report. The majority of the Town's Area properties are currently connected to the Town's municipal sewer system at Surfside. Gravity sewers and pump stations collect and convey the wastewater to the Surfside Wastewater Treatment Facility for treatment and disposal. The recommended plan under Option No. 1, is for the remaining unsewered lots to be connected to the existing collection system at Surfside.

Study Area 14 – Town WPZ

The Town Wellhead Protection Zone (WPZ) is a Needs Area based on vicinity to the Town well water. The majority of the WPZ is connected via gravity sewers to the existing Surfside Collection System and is treated and disposed of at the Surfside Wastewater Treatment Facility. The remaining Town WPZ Study Area is serviced through on-site wastewater disposal systems. At this time, the recommended plan under Option No. 4, is for the Town, under the auspices of the Septage Management Plan. However, the Town should not allow any type of variances to current Title 5 rules and regulations and should established a stringent monitoring program of all on-site wastewater disposal systems in this Study Area to determine if any potential negative impacts to the Town's water supply. If it is determined that the public water supply is being or could be compromised, it is recommended that all the remaining unsewered lots to be connected to the existing collection system at Surfside.

Study Area 15 – Shimmo

The Shimmo Study Area was evaluated in the Phase I Report and determined to be a Needs Area based on the Area's proximity to and potential impact to the Nantucket Harbor Watershed. The recommended plan, under Option No. 2, consists of the installation of 26,315 linear feet of low pressure sewer with sizes ranging from 1-1/4 to 4 inch diameter pipe. The Shimmo collection system will tie in directly to the gravity sewer in the Monomoy Study Area via Polpis Road. Figure 5-4 provides a layout for the proposed Shimmo Collection System.

Both the proposed Monomoy and Shimmo collection systems will discharge to the existing Town collection system at Milestone Road, which will convey the wastewater to the Sea Street Pump Station. The Sea Street Pump Station will then pump the wastewater flows to the Surfside Wastewater Treatment Facility for treatment and disposal.

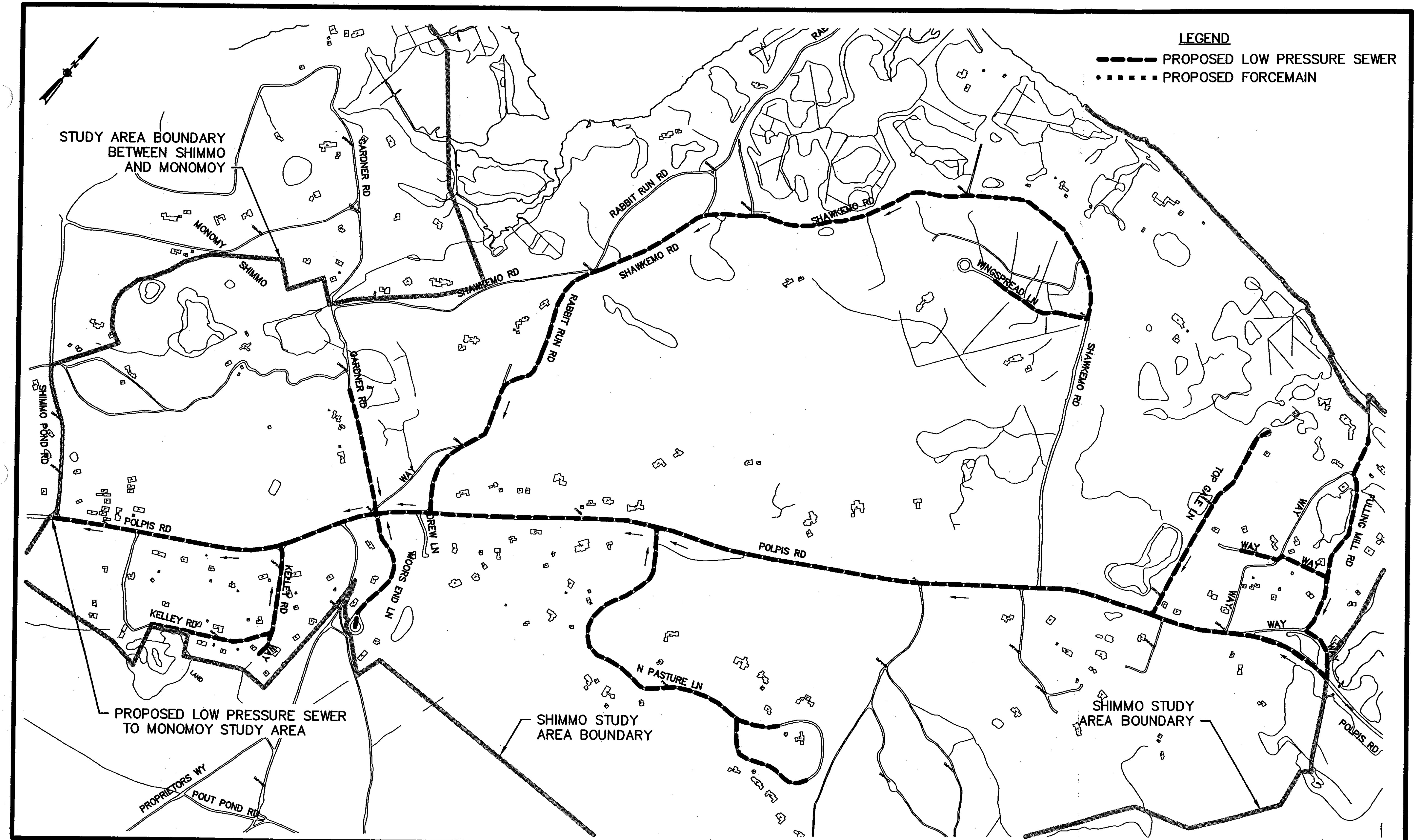


FIGURE 5-4
TOWN OF NANTUCKET
CWMP/FEIR
SHIMMO STUDY AREA
NOT TO SCALE

EARTH TECH

Study Area 16 – Monomoy

The Monomoy Area is a Needs Area based on the proximity to and potential impact to the Nantucket Harbor Watershed. Currently, there are approximately three-percent of the developed lots connected to the Town collection system that conveys wastewater to the Surfside Wastewater Treatment Facility. The recommended plan, under a combination of Option No. 1 and Option No. 2, consists of connecting the remaining Monomoy Study Area to the same collection system via 14,540 linear feet of low-pressure sewer with sizes ranging from 1-1/4 to 4 inch diameter pipe. The collection system also includes 4,730 linear feet of 8-inch gravity sewer that will travel down Polpis Road to Milestone Road, thereby connecting the Monomoy and Shimmo Collection Systems to the Town Collection System. This whole system would connect to the Sea Street Pump Station to be conveyed for treatment and disposal at the Surfside Wastewater Treatment Facility. All sewers will be located in the roadways. Refer to Figure 5-5 for the proposed layout of the Monomoy Collection System.

Study Area 17 – Remaining Island

The Remaining Island Area was evaluated in the Phase I Report as long-term sustainable with the current on-site wastewater disposal systems. Therefore, the recommended plan is Option No. 4, continued use of on-site wastewater disposal systems with oversight from the Town under a Septage Management Plan.

Refer to Table 5-1 for a summary of the recommend plan.

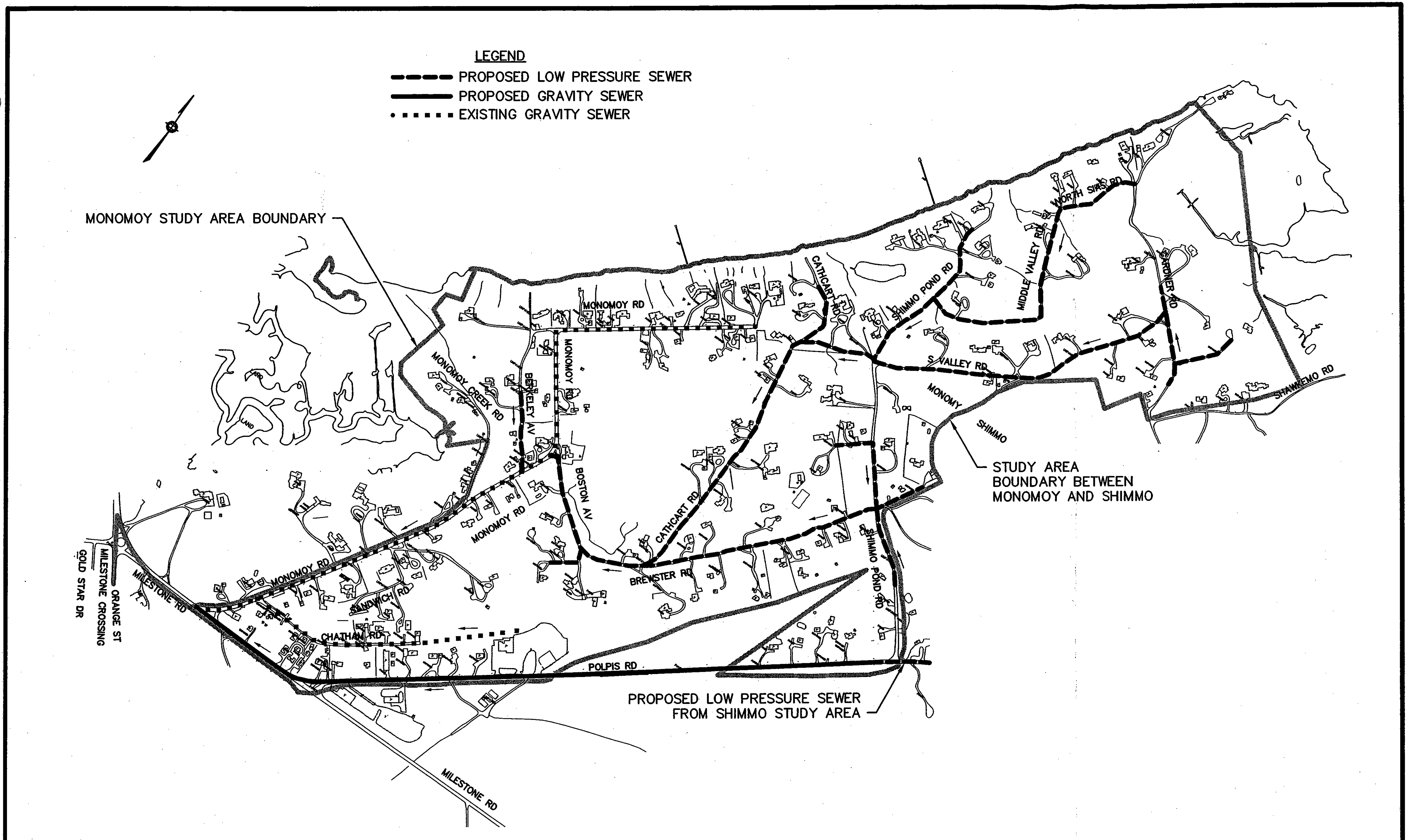


FIGURE 5–5
TOWN OF NANTUCKET
CWMP/FEIR
MONOMOY STUDY AREA
NOT TO SCALE

EARTH TECH

TABLE 5-1
TOWN OF NANTUCKET
CWMP/FEIR
SUMMARY OF RECOMMENDED PLAN

Study Area	Recommended Plan	Study Area	Recommended Plan	Study Area	Recommended Plan
Madaket	• Needs Area Based on Matrix • 39,930 LF Low Pressure Sewer • Treatment at Madaket WWTF	Tom Nevers – Low Density	• Long-term sustainable with the current on-site wastewater disposal systems • Monitored by Septage Management Plan	Polpis	• Needs Area Based on Matrix • Continued Use of On-Site Systems • Monitored by Septage Management Plan • Reevaluated After Completion of The Massachusetts Estuaries Project
Warren's Landing	• Needs Area Based on Matrix • 8,000 LF Low Pressure Sewer • Connection to Madaket Collection System • Treatment at Madaket WWTF	Tom Nevers – High Density	• Long-term sustainable with the current on-site wastewater disposal systems • Monitored by Septage Management Plan	Town	• Needs Area Based on Matrix • Connect All Unsewered Lots to Town Collection System • Treatment at Surfside WWTF
Cisco	• Long-term sustainable with the current on-site wastewater disposal systems • Monitored by Septage Management Plan	Siasconset	• Needs Area Based on Matrix • Treatment at Siasconset WWTF (Currently Under Construction)	Town Wellhead Protection Zone	• Needs Area Based on Well Protection Zone • Continued Use of On-Site Systems • Monitored by Septage Management Plan than Connect All Unsewered Lots to Town Collection System, if necessary • Treatment at Surfside WWTF
Somerset	• Needs Area Based on Matrix • 12,850 LF Gravity Sewer • 7,115 LF Low Pressure Sewer • Connection to Town Collection System • Treatment at Surfside WWTF	Quidnet	• Needs Area Based on Matrix • Continued Use of On-Site Systems • Monitored by Septage Management Plan • Reevaluated After Completion of The Massachusetts Estuaries Project	Shimmo	• Needs Area Based on Harbor Watershed • 26,315 LF of Low Pressure Sewer • Connection to Monomoy Collection System • Treatment at Surfside WWTF
Miacomet	• Long-term sustainable with the current on-site wastewater disposal systems • Monitored by Septage Management Plan	Wauwinet	• Needs Area Based on Matrix • Continued Use of On-Site Systems • Monitored by Septage Management Plan • Reevaluated After Completion of The Massachusetts Estuaries Project	Monomoy	• Needs Area Based on Matrix • 14,540 LF of Low Pressure Sewer • 4,730 LF of Gravity Sewer • Connection to Town Collection System • Treatment at Surfside WWTF
Surfside	• Long-term sustainable with the current on-site wastewater disposal systems • Monitored by Septage Management Plan	Pocomo	• Needs Area Based on Harbor Watershed • Continued Use of On-Site Systems • Monitored by Septage Management Plan • Reevaluated After Completion of The Massachusetts Estuaries Project	Remaining Island	• Long-term sustainable with the current on-site wastewater disposal systems • Monitored by Septage Management Plan

3. Wastewater Treatment Facilities

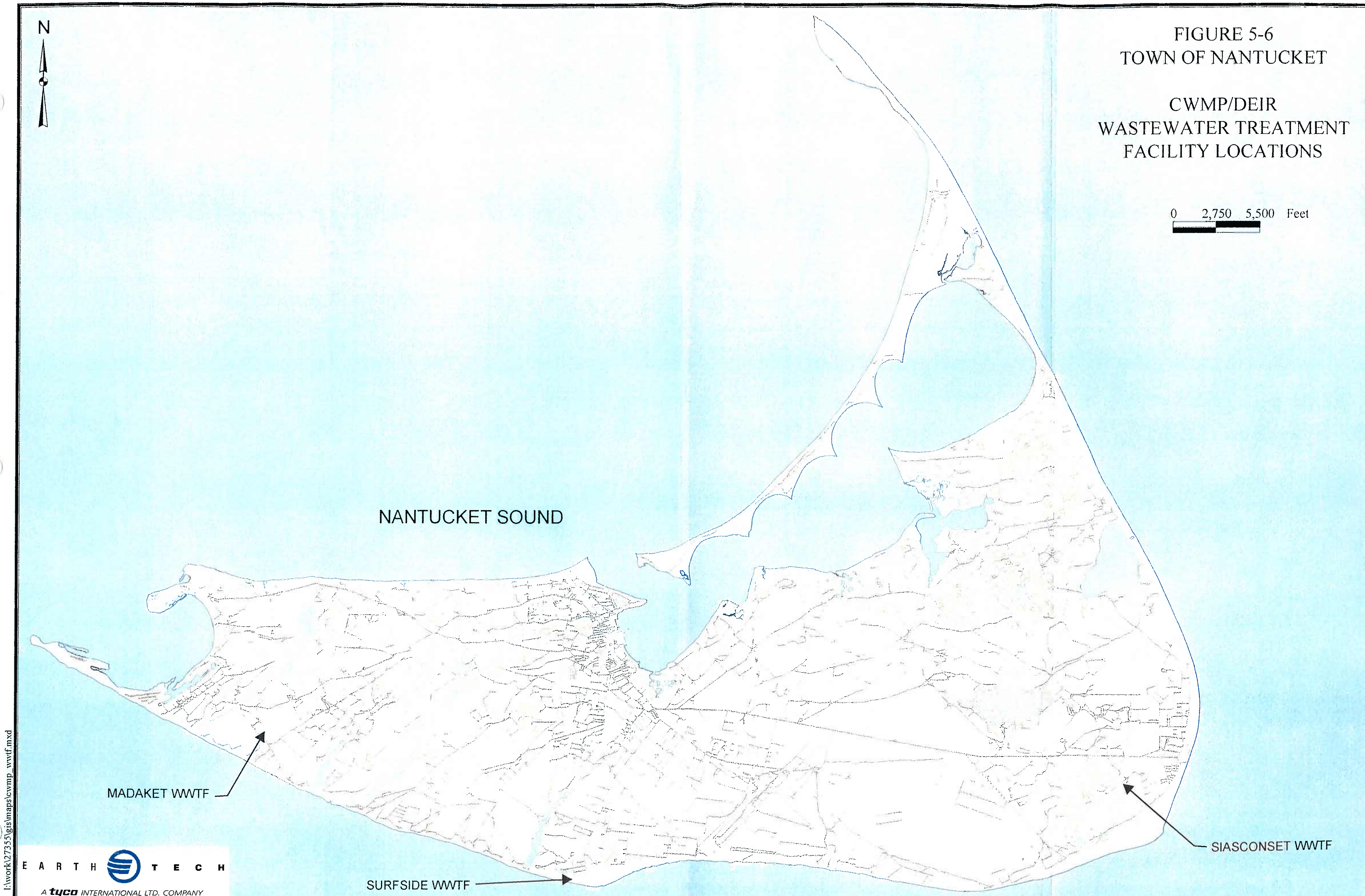
The Island of Nantucket currently operates one wastewater treatment facility, the Surfside Wastewater Treatment Facility (WWTF). The Island's second wastewater treatment facility is currently being constructed in the Siasconset Area. The recommended plan includes the construction of a third wastewater treatment facility in the Madaket Area of the Island. Figure 5-6 shows the locations of three wastewater treatment facilities. Table 5-2 shows the Typical WWTF Effluent Requirements.

TABLE 5-2
TOWN OF NANTUCKET
CWMP/FEIR
TYPICAL WWTF EFFLUENT PERMIT REQUIREMENTS

Effluent Permit Parameter	Monthly Average	Weekly Average	Daily Maximum
BOD_5 (mg/L)	10	15	20
TSS (mg/L)	10	15	20
Settleable Solids (ml/L)	0.1	--	0.3
Fecal Coliform Bacteria (#/100ml)	--	--	200
Total Residual Chlorine (mg/L)	< 1.0	--	1
Toxicity - LC50 (% survival)	--	--	$\geq$ 50
pH	--	--	6.0 to 8.5
Total Nitrogen	10	--	--
NO_3	< 10	--	--
Total Phosphorous	--	--	--
Oil and Grease	15	--	--

Surfside WWTF

The Surfside WWTF, located on South Shore Road in the Southwest region of the Island is currently permitted to discharge 1.80 mgd of advanced primary treated effluent during the summer months into 10 rapid infiltration basins. The service area encompasses approximately 2,000 acres of land out of a total 30,580 acres on the Island. The Surfside WWTF serves approximately 4,000 residential and commercial customers. The Surfside WWTF was built in 1991 and is in dire need of rehabilitation.



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The Town of Nantucket has already begun the next step of upgrading and expanding the existing Surfside WWTF. Earth Tech prepared a Preliminary Design Report (PDR) to identify and develop the necessary upgrades at the WWTF. The PDR includes expanding and improving the headworks, providing secondary treatment for the removal of BOD, TSS and nitrogen, expansion of the effluent disposal beds, sludge processing improvements, septage receiving improvements, and odor control. The PDR was developed with the following project goals in mind that have been identified by the Town:

- Maximize Use of the Existing Site;
- Low Maintenance;
- Operation Without the Use or a Limited Use of Chemicals;
- Capture and Treat Odors;
- Meet High Discharge Limits; and
- Community Acceptance.

The Town requested that the PDR include a cost-effective review of alternatives for providing secondary treatment with biological processes, furnishing expanded sludge dewatering capabilities, and improving the existing odor control facilities. As such, the following alternatives were evaluated:

- Biological Unit Process Alternatives included: (a) Modified Ludzack Ettinger; (b) Sequencing Batch Reactors (SBRs); (c) Trickling Filters; and (d) Rotating Biological Contactors.

- Sludge Processing Alternatives included: (a) High performance Belt Filter Presses, (b) Centrifuges; and (c) Rotary Presses.

- Odor Control Alternatives included: (a) Packed bed scrubbers; (b) Mist chamber scrubbers; and (c) Bio-Filters.

Of these alternatives, SBRs were selected for providing biological secondary treatment, Centrifuges were selected for providing sludge dewatering, and Packed Bed Scrubbers were selected to provide odor control. A recommended plan, including these selected alternatives, was presented in the PDR, and is discussed below and shown on Figure 5-7 and Figure 5-8.

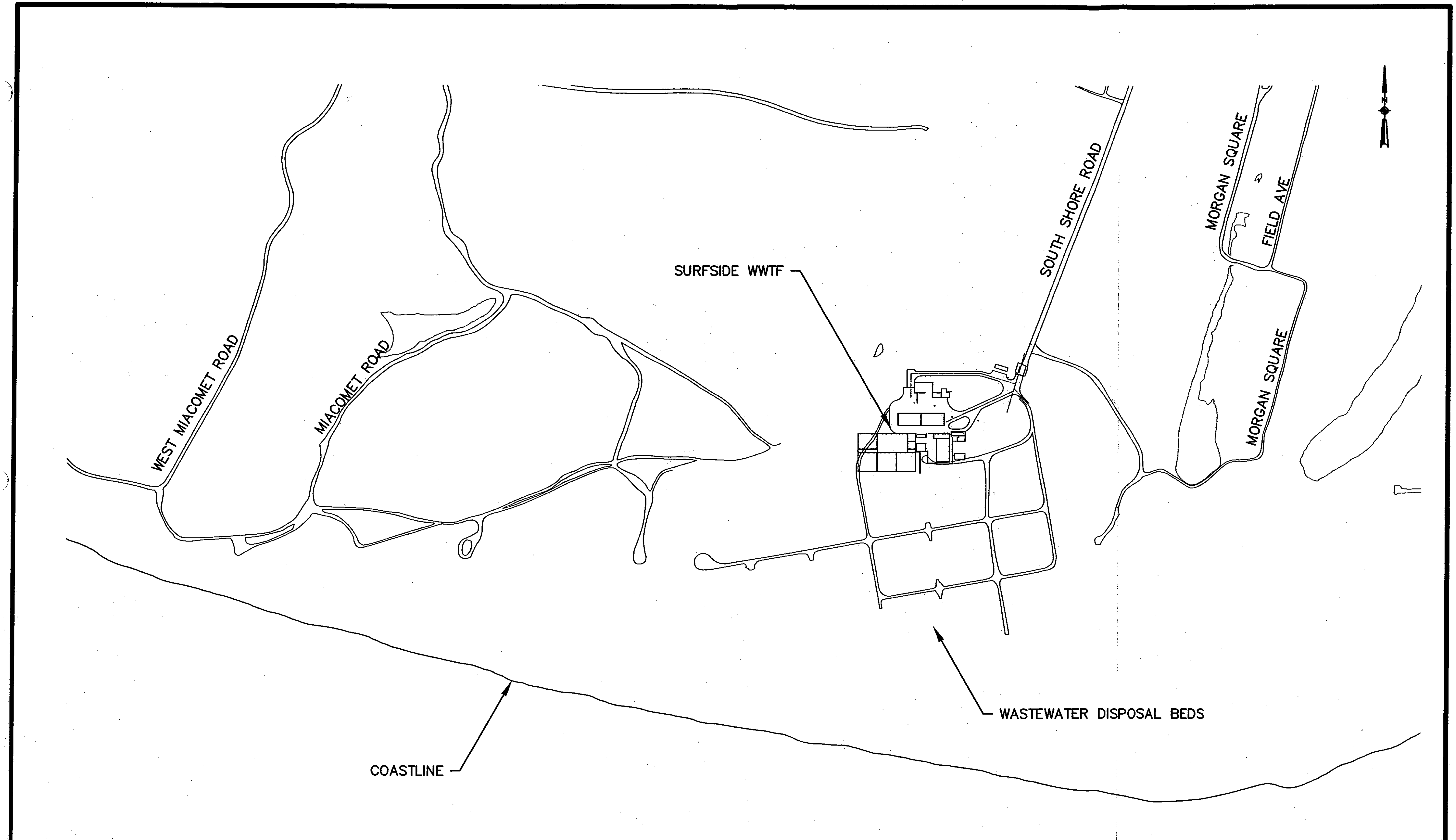

FIGURE 5–7
TOWN OF NANTUCKET
CWMP/FEIR
SURFSIDE WWTF SITE LOCATION
NOT TO SCALE

EARTH TECH

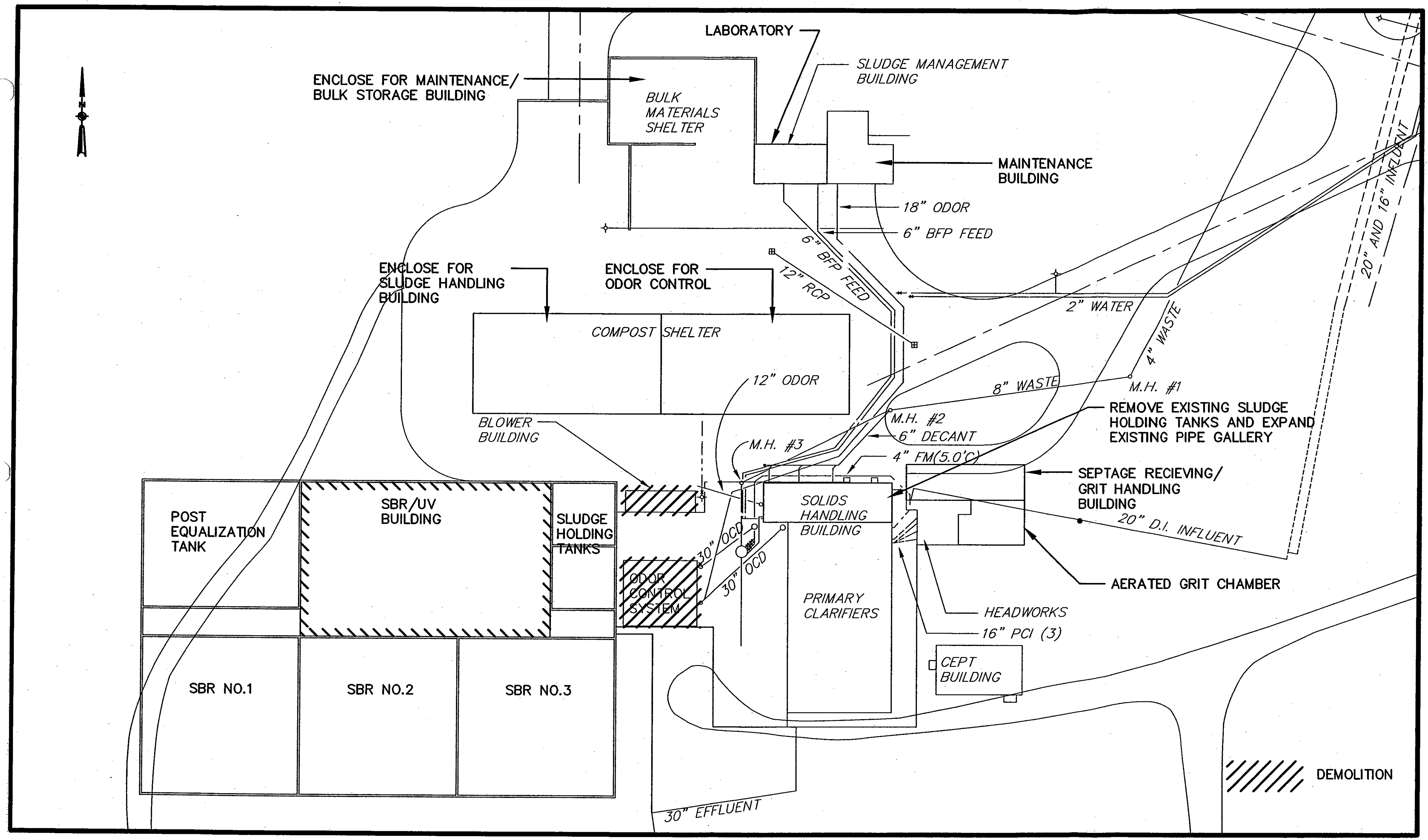

FIGURE 5-8
TOWN OF NANTUCKET
CWMP/FEIR
SURFSIDE WWTF PROCESS LAYOUT
SCALE: 1" = 50'

EARTH TECH

Grit Removal

It is recommended that the existing aerated grit chamber be expanded to provide for a new aerated grit chamber. An additional chamber would allow for operational flexibility, particularly for maintenance. In addition, it is recommended that a building be constructed adjacent to the aerated grit chamber. The new building will be provided with automated grit processing equipment. In addition, the recommendation is for the building to serve as a new septage receiving area. Providing housing around the septage receiving area will prevent the escape of odors. Finally, it is recommended that the aerated grit chambers be covered with aluminum plates and that new ductwork be provided for odor control.

Primary Clarification

The existing rectangular clarifiers have the necessary capacity to handle the design flow, therefore it is recommended that they be kept in service for primary clarification prior to secondary treatment. In addition, it is recommended that the sludge removal equipment, including mechanical drives and pumps, be refurbished and that aluminum covers with ducts for odor control be provided.

Solids Handling Building

It is recommended that the Solids Handling Building be modified by relocating the sludge holding tanks. The existing pipe gallery, which is currently severely congested, could then be expanded into what is now the sludge holding tank area.

Biological Unit Processes

Of the four alternatives evaluated (SBRs, MLE Process, RBCs, and Trickling Filters), SBR's are the recommended alternative for providing secondary treatment. Both RBCs and Trickling Filters are not recommended because they require chemical addition, which is not consistent with the Town’s goals for minimal use of hazardous chemicals. In addition, both RBCs and Trickling Filters require a downstream process for nitrogen removal.

In the evaluation, it was determined that the MLE Process, is a suitable alternative capable of providing the same level of treatment and operation flexibility at approximately the same cost as SBRs. SBRs are recommended because the Siasconset WWTF (currently under construction) is a SBR facility and the proposed Madaket WWTF is anticipated to be an SBR facility. Therefore, SBRs are recommended because it is anticipated that there will be an overall cost savings to the Town and a simplification of operation realized by providing essentially the same treatment process and process equipment at all three facilities.

Effluent Disinfection

Disinfection of the WWTF effluent through the use of an ultraviolet (UV) system using medium-pressure quartz vapor lamps is the recommended method of effluent disinfection. The ultraviolet process is capable of destroying all types of pathogens in clear liquids without the addition of chemicals or heat. UV disinfection is consistent with the Town's goals for minimal use of hazardous chemicals. Most other disinfection alternatives require the use of chemicals.

Effluent Disposal Bed Expansion

The current means of disposing of the treated effluent is through groundwater infiltration by rapid infiltration basins. In order to expand the facility to treat and dispose of the 3.5 MGD future design wastewater flow, an analysis was needed to determine the required infiltration basin capacity. For this determination, a preliminary groundwater model was developed. The model indicated that the existing bed configuration would not be able to accommodate the significantly greater flows being proposed. Since there is sufficient land area for the construction of additional beds at the site, it was decided to use those potential beds in the maximum discharge simulation. Model runs to evaluate the use of additional beds, found that the expanded 3.5 MGD flow could be disposed of through the construction of 5 additional disposal beds. Although additional model simulations may be required in order optimized disposal bed configurations, the site is capable of handling the additional discharge being proposed.

Sludge and Septage Dewatering and Disposal

Of the three alternatives evaluated, belt filter presses, centrifuges, and rotary presses, the recommended alternative for sludge dewatering is centrifuges. An annual cost evaluation, presented in the PDR determined that BFP's and centrifuges are close in cost and that rotary presses are more expensive. Centrifuges are recommended for sludge dewatering because they require less space than belt filter presses and reduce the quantity of odorous air required to be processed in the odor control system.

The sludge dewatering facilities at Surfside will need to have capacity to dewater primary sludge, waste sludge from the SBR's and primary and waste sludge that is hauled from the Siasconset WWTF. In addition, it is recommended that the centrifuges be sized such that they could handle sludge from the planned Madaket WWTF, in an emergency situation. In this manner, the sludge dewatering facilities at Madaket could be smaller because there would be no need for a redundant backup. If dewatering equipment at that Madaket facility needed to be repaired, the sludge could be hauled to the Surfside WWTF. It is recommended that the existing Compost Shelter be enclosed and modified to house the centrifuges. In addition, it is recommended that the layout be designed such that the trucks used to haul the dewatered sludge, could park and load within the renovated sludge building. In this manner, odorous air could be contained and therefore minimize odor problems at the facility.

As was previously discussed, it is recommended that a new building be constructed to house both the grit processing equipment and septage receiving. Having the septage hauling trucks park and unload septage within an enclosed building will allow for capturing the odorous air and therefore reduce odor problems at the facility.

Odor Control

A packed media scrubber system is recommended to "scrub" odorous air generated at the WWTF. Although the biofilter alternative does not require hazardous chemical, the volume of air requiring treatment makes the biofilter cost prohibitive.

Building Renovations

There are several building renovations being recommended. As previously discussed, it is recommended that the sludge holding tanks be relocated so that the pipe gallery in the existing Solids Handling Building could be expanded to relieve congestion. It is recommended that the existing Compost Shelter be enclosed and used as a Sludge Handling Building. It is recommended that the existing Sludge Management Building be renovated to use part of the building as a laboratory and part of the building as a maintenance building. In this manner, a much needed enclosed maintenance work area will be provided and the Administrative Building that now houses the Laboratory could become more of a true Administration Building. Finally, it is recommended that the existing Bulk Material Shelter be enclosed and used for large equipment maintenance and bulk storage. This would provide a much needed area, out of the elements, for storage and maintenance. Table 5-3 presents the wastewater flow components and Table 5-4 shows the Surfside WWTF Design Criteria for Future Design Summer 2025.

TABLE 5-3
TOWN OF NANTUCKET
CWMP/FEIR
SURFSIDE WWTF WASTEWATER FLOWS

	Wastewater Flow (MGD) - Winter			Wastewater Flow (MGD) - Summer		
Flow Component	Existing	Initial	Design	Existing	Initial	Design
(a) Average Daily Residential	1,239,875	1,353,275	1,591,000	1,526,000	2,340,800	2,752,160
(b) Average Daily Industrial	-	-	-	-	-	-
(c) Average Daily Commercial	221,325	179,400	193,700	293,680	238,050	257,025
(d) Average Daily Institutional/Special	-	-	-	-	-	-
(e) Average Daily Intermunicipal	-	-	-	-	-	-
(f) Septage	5,400	25,000	25,000	11,200	40,000	40,000
Average Daily Total [1]	1,466,600	1,557,675	1,809,700	1,830,880	2,618,850	3,049,185
Peaking Factor	2.80	2.77	2.70	2.70	2.53	2.47
Peak Wastewater [2]	4,112,673	4,321,969	4,890,374	4,937,481	6,631,035	7,516,558
Average Daily Infiltration [3 & 4]	900,000	450,000	450,000	450,000	225,000	225,000
Maximum Monthly Infiltration	1,800,000	900,000	900,000	900,000	450,000	450,000
Maximum Peak Inflow	1,150,000	575,000	575,000	575,000	287,500	287,500
Average Annual Flow [5]	2,366,600	2,007,675	2,259,700	2,280,880	2,843,850	3,274,185
Maximum Monthly Average Flow [6]	3,266,600	2,457,675	2,709,700	2,730,880	3,068,850	3,499,185
Maximum Daily Flow [7]	4,416,600	3,032,675	3,284,700	3,305,880	3,356,350	3,786,685
Maximum Hourly Flow [8]	7,062,673	5,796,969	6,365,374	6,412,481	7,368,535	8,254,058

Notes:

[1] Sum of components a through f

[2] Average Daily Total multiplied by peaking factor

[3] Initial Infiltration based on approximately 5,070 connections at 35 linear feet of service pipe per connection and 300 gpdidm plus 34 miles of pipe and 1,000 gpdidm

[4] Design Infiltration based on approximately 9,346 connections at 35 linear feet of service pipe per connection and 300 gpdidm plus 34 miles of pipe and 1,000 gpdidm

[5] Average Daily Total plus Average Daily Infiltration

[6] Average Daily Total plus Maximum Monthly Infiltration

[7] Average Daily Total plus Maximum Monthly Infiltration plus Maximum Inflow

[8] Peak Wastewater plus Maximum Monthly Infiltration plus Maximum Inflow

TABLE 5-4
TOWN OF NANTUCKET
CWMP/FEIR
SURFSIDE WWTF DESIGN CRITERIA

Description	Future Design Summer 2025
A. Flows and Loadings	
Flow (mgd)	3.5
BOD_5 Concentration (mg/l)	300
TSS Concentration (mg/l)	200
TKN Concentration (mg/l)	40
NH_4-N Concentration (mg/l)	25
Total P Concentration (mg/l)	10
WWTF Design Flow Average Day, Peak Month (mgd)	3.500
WWTF Max. Day, Peak Month (mgd)	5.250
Design Flow Peaking Factor	2.20
WWTF Design Instantaneous Maximum Flow (mgd)	7.700
B. Primary Treatment	
No. of Units	3
Type	Rectangular
Length Each (ft.)	81.5
Width Each (ft.)	18
Sidewater Depth each (ft.)	7
Overflow Rate at Design Flow (gpd/ft^2)	795
Overflow Rate at Maximum Day Flow (gpd/ft^2)	1193
Overflow Rate at Instantaneous Peak Flow (gpd/ft^2)	1750
Detention Time at Design Flow (hrs.)	1.6
C. SBR System	
Length, feet	87
Width, feet	87
Maximum Depth, feet	16
Volume (MG)	0.906
Total No. of Units (each)	3
No. of Cycles (per day/basin)	5
Cycle Duration (hours/cycle)	4.8
Hydraulic Retention Time (Day) at design flow	0.776
D. Post Equalization	
No. of Units	1
Maximum Sidewater Depth, ft	Varies
Volume, MG (Each)	1.8120
Detention Time at Average Flow (hrs.)	12.4
Detention Time at Instantaneous Maximum Flow (hrs.)	8.3

**TABLE 5-4 (cont)
TOWN OF NANTUCKET
CWMP/FEIR
SURFSIDE WWTF DESIGN CRITERIA**

	Description	Future Design Summer 2025
E.	**Ultra - Violet Disinfection**	
	Type of Unit	Medium Pressure
	Type of Structure	Open Channel
	Number of Units (each)	2
	Number of Modules Per Unit (each)	4
	Number of Lamps per Module (each)	24
	Total Number of Lamps Per Unit	96
	U.V. Dosage, each unit (Microwatts-sec/cm^2)	51,640
	U.V. Transmission (percent)	65
	Channel Water Depth (inches)	42
F.	**Sludge Holding**	
	No. of Raw Sludge Tanks	2
	Storage Volume (gal), each	130,000
	Estimated Daily Sludge Quantity (lbs/day)	10,073
G.	**Odor Control System**	
	Type of System	Single-Stage
	Method of Treatment	Packed Tower
	Inlet H_2S, ppm	20
	Estimated Air Flow - Grit Chambers (cfm)	300
	Estimated Air Flow - Headworks Building	3,600
	Estimated Air Flow - Primary Clarifiers	2,700
	Estimated Air Flow - SBRs (cfm)	20,500
	Estimated Air Flow - Post Equalization Tanks (cfm)	5,300
	Estimated Air Flow - Sludge Management Building (cfm)	1,200
	Estimated Air Flow-Sludge Holding Tanks (cfm)	1,400
	Estimated Total Air Flow - (cfm)	35,000
	Equivalent H2S Concentration (ppm)	20
H.	**Sludge Dewatering**	
	Type of System	Centrifuges
	Number of Units	2
	Throughput (gpm each)	110
	Run Time (hours per week)	37
	Dry Solids (lbs/day)	10,700

Siasconset WWTF

Since the abandonment of the Siasconset WWTF project in 1990, the existing effluent beds have been improved, however untreated wastewater is still being discharged to the ground through rapid infiltration basins in violation of the Town's Administrative Order, Docket No. 782 dated June 6, 1989 from Massachusetts DEP. The Order required completion of construction and commencement of operation of the Siasconset treatment facility by June 1, 1991. The Town does have a Class 3 Discharge License (# 0-201) for this site. Due to the abandonment of the proposed site for the treatment facility, the Town proceeded with a Facilities Plan in July 1994 to find a solution to its wastewater problems in the Siasconset area. The Town and DEP negotiated Administrative Consent Order No. SE-97-1006 signed November 1997, with a revised schedule for this project that provides for completion of an approved treatment facility and the cessation of the discharge of untreated sewage by May 2002. A copy of this Administrative Consent Order is in Appendix A.

The Department of Environmental Protection requested that the Town of Nantucket file an Environmental Notification Form (ENF) under the Massachusetts Environmental Policy Act (MEPA) to ensure a thorough and coordinated review of the project by all permitting authorities. An ENF for the proposed project (EOEA No. 11460) was submitted to the MEPA Unit of the Massachusetts Executive Office of Environmental Affairs for the January 15, 1998, filing date. Following publication in the *Environmental Monitor*, staff of the MEPA Unit conducted a public consultation session on February 13, 1998. The Secretary of Environmental Affairs issued a *Certificate on the ENF* on February 24, 1998, requiring the preparation of an EIR and establishing a Special Procedure under Section 11.12 of the MEPA Regulations. This Special Procedure requires the submittal of a Phase I Screening Report to screen the set of alternatives to a reasonable number of alternatives for detailed review. The subsequent filing of a Draft Environmental Impact Report/Facilities Plan (EIR/FP) and a Final EIR/FP was also required.

In accordance with the Secretary's decision on the ENF, a Phase 1 Environmental Report – Screening of Alternative Sites - was submitted to the MEPA unit on July 15, 1998. The Secretary of Environmental Affairs issued a *Certificate on the Special Procedure: Phase I Report, Screening Alternatives* on August 28, 1998. The Secretary determined that the Phase I report fulfilled the requirements set forth in the Phase I report scope outlined in the ENF Certificate.

The Draft Environmental Impact Report/Facilities Plan was submitted to the MEPA unit on December 23, 1998. A 30-day public comment period was initiated by a notice of the Draft EIR/FP's availability for review in the *Environmental Monitor* that was published on January 10, 1999. On February 16, 1999, the Secretary of Environmental Affairs issued a *Certificate on the Special Procedure: Phase II Report, Draft Environmental Impact Report/Facilities Plan* stating that the DEIR/FP adequately and properly complies with MEPA and with its implementing regulations. The Administrative Consent Order stated that a FEIR/FP was to be filed within 120 days of the approval of the DEIR/FP. The initial FEIR/FP was filed with MEPA on June 16, 1999. On July 30, 1999, the Secretary of Environmental Affairs issued a *Certificate on the Special Procedure: Phase III Report, Final Environmental Impact Report/Facilities Plan* stating that the FEIR/FP adequately and properly complies with MEPA and with its implementing regulations. Modifications were made to the *Special Procedure*, which allowed for the submission of a Supplemental FEIR/FP covering the effluent disposal portion of this Project. The PDR is based on the initial Facilities Plan, ENF, DEIR/FP, and FEIR/FP which were all submitted to and approved by MEPA through the Special Procedure under Section 11.12 of the MEPA Regulations.

The Siasconset Wastewater Treatment Facility Project consists of a new WWTF, Influent Pumping Station and modifications to the existing rapid infiltration basins. The new Influent Pumping Station will be remote from the WWTF and located off the basin gravel access road just South of Low Beach Road. The new facilities will be designed to treat a future summer average daily flow of 0.22 mgd and an instantaneous maximum flow of 1.039 mgd. Refer to Figure 5-9 for the Siasconset WWTF location and to Figure 5-10 for the Process Layout.

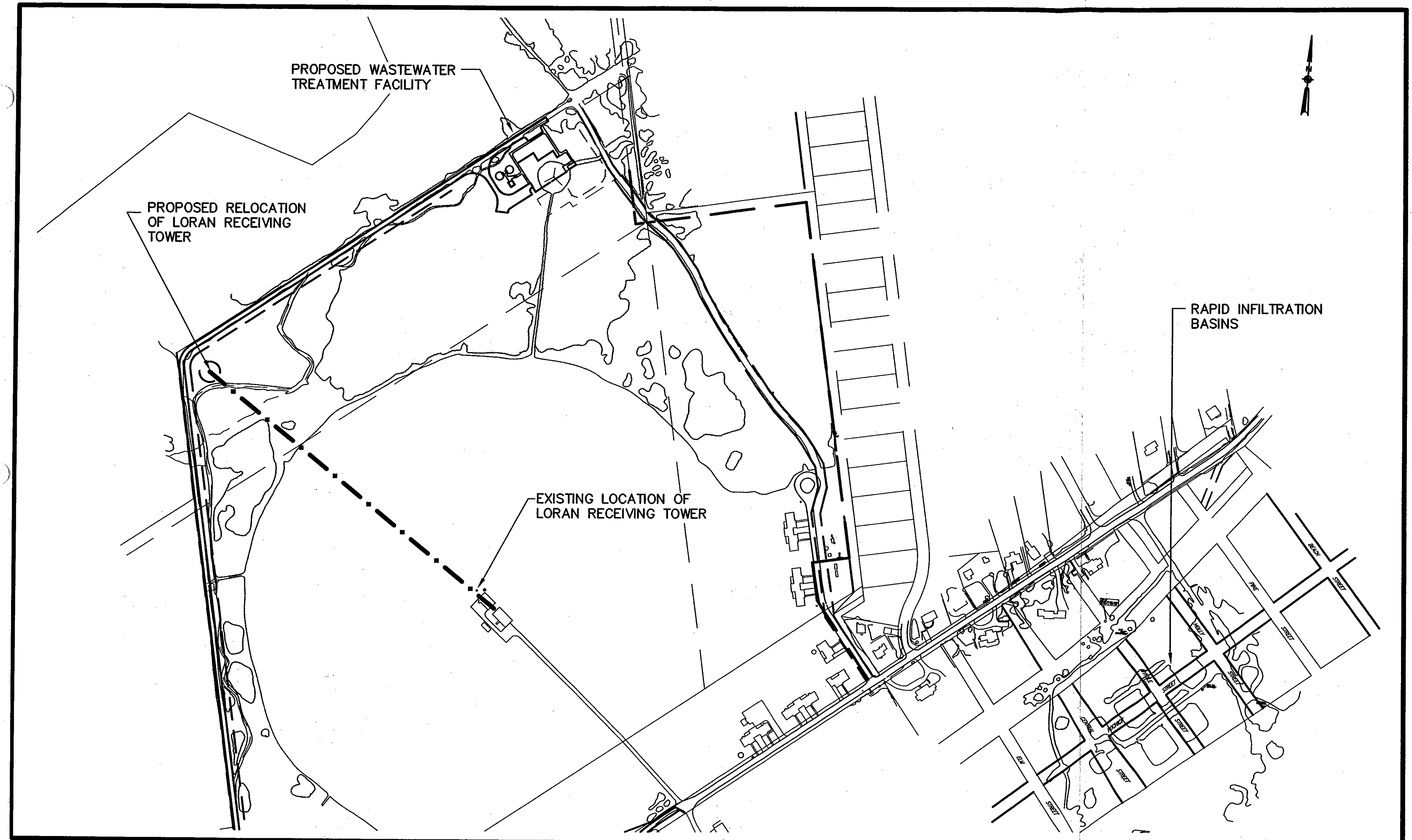

FIGURE 5-9
TOWN OF NANTUCKET
CWMP/FEIR
SIASCONSET WWTF SITE LOCATION
NOT TO SCALE

EARTH TECH

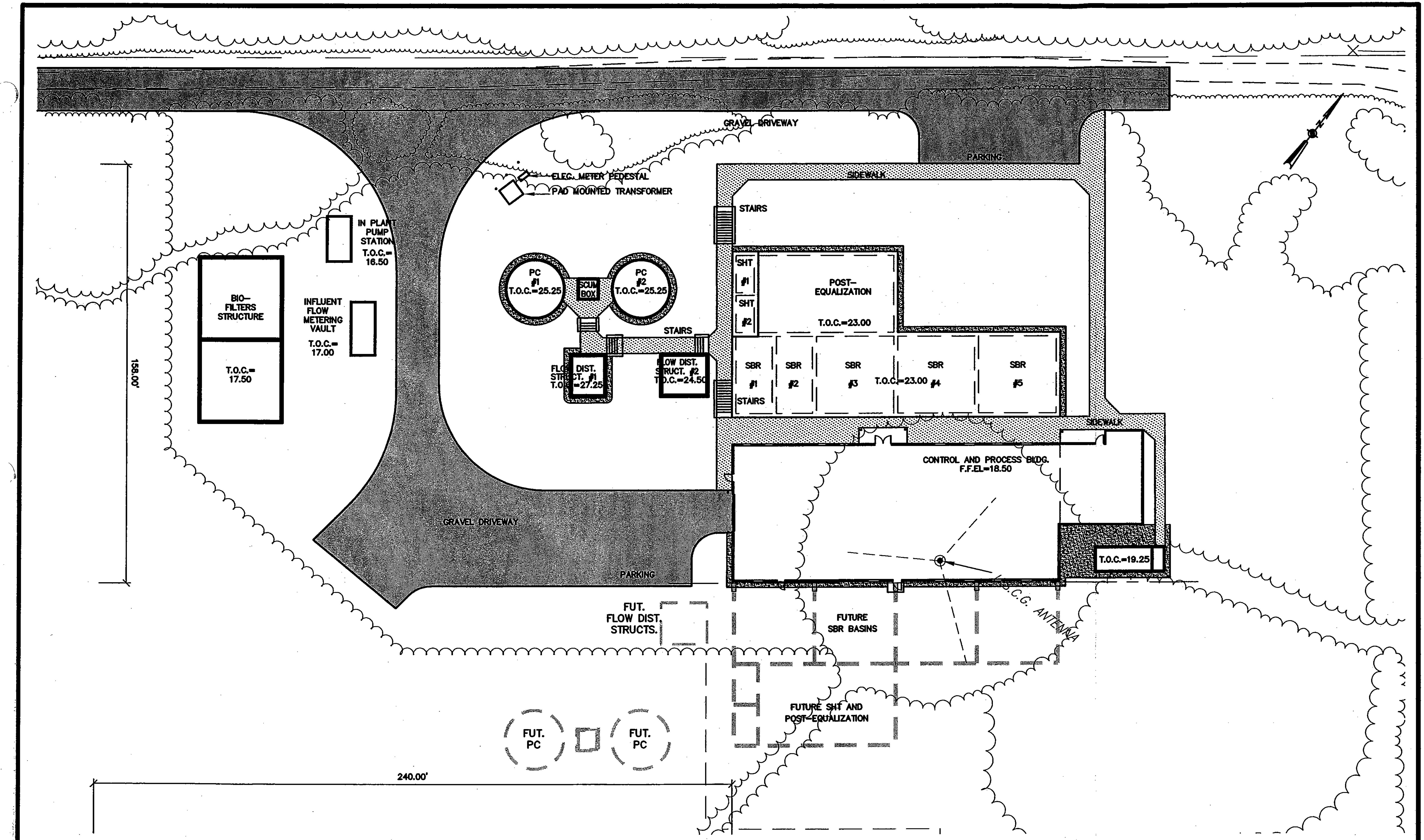

FIGURE 5–10
TOWN OF NANTUCKET
CWMP/FEIR
SIASCONSET WWTF PROCESS LAYOUT
NOT TO SCALE

EARTH TECH

Refer to Table 5-5 for the Siasconset WWTF Design Criteria. The WWTF will be designed to remove conventional pollutants (BOD and TSS) and to significantly reduce the amount of total nitrogen in the WWTF effluent to the basins. The following is a summary of the major treatment components of the new Siasconset WWTF:

- Wastewater Treatment Facility Control and Process Building;
- One influent pumping station;
- One influent flow metering structure;
- Two primary clarifiers with scum collection;
- Five sequencing batch reactor secondary treatment process systems;
- One sodium bicarbonate ($NaHCO_3$) chemical feed system to provide supplemental alkalinity to the SBR system if needed;
- One post-equalization tank with coarse bubble aeration and effluent pumping;
- Two sludge-holding tanks with mechanical mixing and decant equipment;
- Two cloth disk type effluent filters to provide tertiary treatment of the SBR Effluent;
- Two ultraviolet disinfection units providing final treatment prior to disposal via the rapid infiltration basins;
- One effluent sump for effluent reuse via plant water and effluent filter high pressure wash systems;
- One plant water system;
- One effluent flow metering structure;
- Six rapid infiltration basins for final WWTF effluent disposal. The six basins will consist of modifications to the four existing Town rapid infiltration basins and modifications to the two existing Coast Guard basins;
- WWTF effluent piping to the rapid infiltration basins; and
- Two bio-filter type odor control system cells and exhaust fan to treat odorous air exhausted from the primary clarifiers, sequencing batch reactors, sludge holding tanks, post-equalization tank and the sludge pumping truck.

The proposed site for the Siasconset WWTF will be approximately five acres, located on two parcels of land owned by the United States Coast Guard.

TABLE 5-5
TOWN OF NANTUCKET
CWMP/FEIR
SIASCONSET WWTF DESIGN CRITERIA

Description	Future Design Summer 2022
A. Flows and Loadings	
Residential/Commercial Flow (gpd)	208,500
Infiltration/Inflow (gpd)	11,500
BOD_5 Concentration (mg/L)	376
TSS Concentration (mg/L)	345
TKN Concentration (mg/L)	40
Ammonia-Nitrogen Concentration (mg/L)	25
WWTF Design Flow Average Day, Peak Month (mgd)	0.220
Design Flow Peaking Factor	4.93
WWTF Design Instantaneous Maximum Flow (mgd)	1.039
Design BOD5 Load Average Day, Peak Month (lbs./day)	691
Design TSS Load Average Day, Peak Month (lbs./day)	634
Design TKN Load Average Day, Peak Month (lbs./day)	73
Design Ammonia-Nitrogen Load, Average Day, Peak Month (lbs./day)	46
B. Primary Treatment	
No. of Units	2
Type	Circular
Diameter (each, feet)	20
Sidewater Depth each, (feet)	12
BOD_5 Removal	30%
TSS Removal	60%
Overflow Rate at Monthly Average Flow (gpd/ft^2)	384
Overflow Rate at Instantaneous Maximum Flow (gpd/ft^2)	1,655
Weir Loading at Monthly Average Flow (gpd/ft)	1,920
Weir Loading at Instantaneous Maximum Flow (gpd/ft)	8,271
C. SBR System	
Number of Reactor Basins – Large Units	3
Length of Reactor Basins (feet)	29
Width of Reactor Basins (feet)	29
Depth of Reactor Basins (feet)	20
Maximum Volume (each, Mgal)	0.126
Total No. of Decanters	3
Maximum Decant Rate (each, gpm)	969
Number of Reactor Basins – Small Units	2
Length of Reactor Basins (feet)	29
Width of Reactor Basins (feet)	14.5
Depth of Reactor Basins (feet)	20
Maximum Volume (each, Mgal)	0.063
Total No. of Decanters	2
Maximum Decant Rate (each, gpm)	475

TABLE 5-5 (cont)
TOWN OF NANTUCKET
CWMP/FEIR
SIASCONSET WWTF DESIGN CRITERIA

Description	Future Design Summer 2022
D. Post Equalization	
No. of Tanks	1
Tank Width (feet)	29
Tank Length (feet)	65
Tank Sidewater Depth (feet)	8
Effective Tank Volume (gals)	112,800
E. Filtration	
Type of Treatment	Cloth Media Filter
Number of Filter Units (each)	2
Number of Filter Disks per Unit (each)	6
Average Flow to Filters (gpm)	164
Maximum Flow to Filters (gpm)	300
F. Ultra-Violet Disinfection	
Type of Disinfection	Ultraviolet
Type of Structure	S.S. Channel
Number of Units	2
Capacity per Unit (gpd)	500,000
Channel Length, each, including transition boxes (feet)	13.6
Channel Width (feet)	1.25
Channel Depth (inches)	23
Channel Water Depth (inches)	11.5-12.5
U.V. Transmission (percent)	65
G. Sludge Holding	
No. of Tanks	2
Tank Length (feet)	14
Tank Width (feet)	12
Sidewater Depth (feet)	10
Total Storage Volume (gal.)	25,130
Estimated Sludge Quantity including decant (lbs./day)	662
Estimated Sludge Volume including decant (gpd)	1,600
Design Storage Time (days)	15.7

TABLE 5-5 (cont)
TOWN OF NANTUCKET
CWMP/FEIR
SIASCONSET WWTF DESIGN CRITERIA

Description	Future Design Summer 2022
H. Odor Control System	
Type	BioFilter
Arrangement	Air Upflow
Media Type	Organic Mixture
Media Support Type	1- 1/2" Gravel
Estimated Air Flow (cfm)	4,500
Retention Time (sec)	72
Media Depth (feet)	3
I. Effluent Discharge Beds	
Total Number of Beds	4
Beds in Use	4
Length of Bed, each (feet)	100
Width of Bed, each (feet)	100
Design Loading Rate (gpd/ft^2)	4
Effective Loading Rate	3.7

Madaket WWTF

The proposed Madaket Wastewater Treatment Facility (WWTF) will be located on a parcel currently owned by the Federal Aviation Administration, located near the Madaket Study Area. Wastewater treatment, consisting of tanks, equipment and an access road will encompass approximately four acres of land. The groundwater discharge site will encompass approximately six and a half acres. The Madaket Wastewater Treatment Facility will consist of an Influent Pumping Station, which will receive wastewater flow from the Madaket and Warren's Landing Study Areas, treatment equipment including sequencing batch reactors (SBRs), and Infiltrators for groundwater discharge. The new facilities will be designed to treat a future summer average daily flow of 0.35 MGD. The WWTF will be designed to remove conventional pollutants such as BOD, TSS and Total Nitrogen. Refer to Figure 5-11 for the Madaket WWTF location and Figure 5-12 for the Process Layout.

FIGURE 5–11
TOWN OF NANTUCKET
CWMP/FEIR
MADAKET WWTF SITE LOCATION
NOT TO SCALE

EARTH TECH

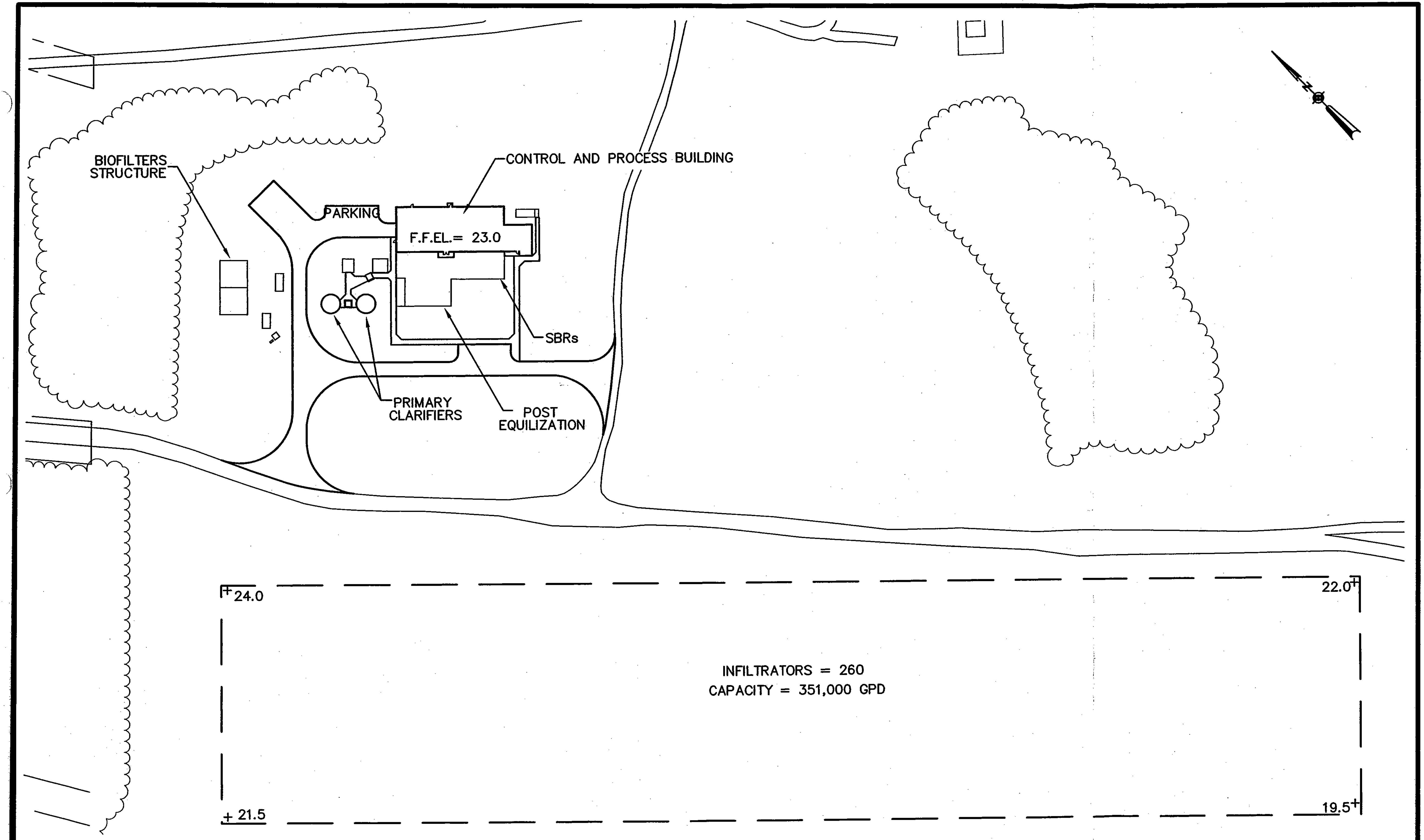

FIGURE 5-12
TOWN OF NANTUCKET
CWMP/FEIR
MADAKET WWTF PROCESS LAYOUT
NOT TO SCALE

EARTH TECH

Refer to Table 5-6 presents the wastewater flow components and Table 5-7 for the Madaket WWTF Design Criteria for Future Design Summer 2025. The WWTF will be designed to remove conventional pollutants (BOD and TSS) and to significantly reduce the amount of total nitrogen in the WWTF effluent to the groundwater site. The following is a summary of the major components of the Madaket WWTF:

- Wastewater Treatment Facility Control and Process Building;
- WWTF Influent Pumping Station;
- One influent flow metering structure;
- Two primary clarifiers with scum collection;
- Two sequencing batch reactor (SBR) secondary treatment process systems;
- Two post-equalization tanks with coarse bubble aeration and effluent pumping;
- Two sludge-holding tanks with mechanical mixing and decant equipment;
- Two cloth disk type effluent filters to provide tertiary treatment of the SBR Effluent;
- Two ultraviolet disinfection units providing final treatment prior to disposal;
- One effluent sump for effluent reuse via plant water and effluent filter high pressure wash systems;
- One plant water system;
- One effluent flow metering structure;
- 260 Infiltrators for final WWTF effluent disposal;
- One centrifuge for dewatering of sludge produced during treatment; and
- Two bio-filter odor control system cells and an exhaust fan to treat odorous air exhausted from the primary clarifiers, sequencing batch reactors, sludge holding tanks, post-equalization tank, sludge pumping truck, and the centrifuge area.

TABLE 5-6
TOWN OF NANTUCKET
CWMP/FEIR
MADAKET WWTF WASTEWATER FLOWS

Flow Component	Wastewater Flow (MGD) - Winter			Wastewater Flow (MGD) - Summer		
	Existing	Initial	Design	Existing	Initial	Design
(a) Average Daily Residential	-	156,430	185,470	-	270,580	320,800
(b) Average Daily Industrial	-	-	-	-	-	-
(c) Average Daily Commercial	-	520	520	-	690	690
(d) Average Daily Institutional/Special	-	-	-	-	-	-
(e) Average Daily Intermunicipal	-	-	-	-	-	-
(f) Septage	-	-	-	-	-	-
Average Daily Total [1]	-	156,950	185,990	-	271,270	321,490
Peaking Factor	-	4.52	4.36	-	4.01	3.86
Peak Wastewater [2]	-	709,972	810,246	-	1,086,859	1,240,446
Average Daily Infiltration [3 & 4]	-	9,000	17,000	-	-	-
Maximum Monthly Infiltration	-	18,000	34,000	-	-	-
Maximum Peak Inflow	-	-	-	-	-	-
Average Annual Flow [5]	-	165,950	202,990	-	271,270	321,490
Maximum Monthly Average Flow [6]	-	174,950	219,990	-	271,270	321,490
Maximum Daily Flow [7]	-	174,950	219,990	-	271,270	321,490
Maximum Hourly Flow [8]	-	727,972	844,246	-	1,086,859	1,240,446

Notes:

[1] Sum of components a through f
[2] Average Daily Total multiplied by peaking factor
[3] Initial Infiltration based on approximately 540 connections at 50 linear feet of service pipe per connection and 300 gpdidm
[4] Design Infiltration based on approximately 1,000 connections at 50 linear feet of service pipe per connection and 300 gpdidm
[5] Average Daily Total plus Average Daily Infiltration
[6] Average Daily Total plus Maximum Monthly Infiltration
[7] Average Daily Total plus Maximum Monthly Infiltration plus Maximum Inflow
[8] Peak Wastewater plus Maximum Monthly Infiltration plus Maximum Inflow

TABLE 5-7
TOWN OF NANTUCKET
CWMP/FEIR
MADAKET WWTF DESIGN CRITERIA

Description	Future Design Summer 2025
A. Flows and Loadings	
Residential Flow (mgd)	0.35
BOD_5 Concentration (mg/l)	300
TSS Concentration (mg/l)	200
TKN Concentration (mg/l)	40
NH_4-N Concentration (mg/l)	25
Total P Concentration (mg/l)	10
WWTF Design Flow Average Day, Peak Month (mgd)	0.350
WWTF Max. Day, Peak Month (mgd)	0.875
Design Flow Peaking Factor	4.20
WWTF Design Instantaneous Maximum Flow (mgd)	1.470
B. Primary Treatment	
No. of Units	2
Type	Circular
Diameter (ft.)	18
Sidewater Depth each (ft.)	10
Overflow Rate at Design Flow (gpd/ft2)	688
Overflow Rate at Maximum Day Flow (gpd/ft^2)	1,719
Overflow Rate at Instantaneous Peak Flow (gpd/ft^2)	2,888
Detention Time at Design Flow (hrs.)	2.6
C. SBR System	
Length, feet	36
Width, feet	36
Maximum Depth, feet	18
Volume (MG)	0.174
Total No. of Units (each)	2
No. of Cycles (per day/basin)	5
Cycle Duration (hours/cycle)	4.8
Hydraulic Retention Time (Day) at design flow	0.797
D. Post Equalization	
No. of Units	2
Maximum Sidewater Depth, ft	10
Volume, MG (Each)	0.046
Detention Time at Average Flow (hrs.)	6.3

TABLE 5-7 (cont)
TOWN OF NANTUCKET
CWMP/FEIR
MADAKET WWTF DESIGN CRITERIA

Description	Future Design Summer 2025
E. Filtration	
Type of Unit	Cloth Media Filter
Design Flow, mgd	0.700
Number of Units	2
Hydraulic Loading Rate, gpm per ft^2	3.25
Filter Area, ft^2	107.6
F. Ultra-Violet Disinfection	
Type of Unit	Medium Pressure
Type of Structure	Open Channel
Design Flow (mgd)	0.350
Design Maximum Day Flow (mgd)	0.875
Number of Units (each)	1.0000
Number of Modules Per Unit (each)	7
Number of Lamps per Module (each)	4
Total Number of Lamps Per Unit	28
U.V. Transmission (percent)	65
Channel Water Depth (inches)	21
G. Sludge Holding	
No. of Raw Sludge Tanks	2
Storage Volume (gal), each	210,000
Estimated Daily Sludge Quantity (lbs/day)	16,025
H. Odor Control System	
Type of System	Biofilter
Inlet H_2S, ppm	20
Estimated Air Flow, cfm	8,000
Number of Cells	2
Ave. Loading Rate, cfm/ft^2	2.50
Area per Cell, ft^2	1,600
I. Sludge Dewatering	
Type of System	Centrifuge
Number of Units	1
Throughput (gpm each)	50
Run Time (hours per week)	16

4. Existing Pump Stations

The Town of Nantucket currently operates and maintains six wastewater pumping stations. All six pump stations convey flow to the existing Surfside Wastewater Treatment Facility. The recommended plan does not include any new pump stations and recommends rehabilitating the six current pumping stations. The following are the recommended upgrades:

- **Airport Pump Station** – (a) Replace the station's badly corroded control panels with a epoxy-coated corrosion-resistant housing; and (b) Install flow-measuring instrument.
- **Cato Lane Pump Station** – (a) Due to the poor condition of the entire station, demolish and install a submersible pump station in its place. The replacement of the Cato Lane Pump Station has been incorporated into the Siasconset Wastewater Treatment Facility Project. As of the submission of this report, the Cato Lane Pump Station has been totally replace and put into operation.
- **Old South Road Station** – (a) Perform a detailed hydraulic analysis of the station to determine the efficiency of the existing pumps. Current and future wastewater flows should be taken into consideration; (b) Replace the control panel due to inaccessible replacement parts; and (c) Install an alarm system.
- **Pine Valley Pump Station** – (a) Install flow measuring equipment.
- **Sea Street Pump Station** – (a) Install an alarm system; and (2) Update the VFD's. Minimization of the grease entering the station would reduce operation and maintenance costs. Therefore, investigation of the cause of the consistent grease problems in the area should be undertaken and addressed.
- **Surfside Pump Station** – (a) Install an alarm system; (b) Replace the control panel due to inaccessibility to obtain replacement parts; and (c) Replace the generator with a generator that is capable of handling both pumps.
- **Portable Generator -** (a) Sandblast housing of the generator to remove rust and apply a protected epoxy-based corrosion-resistant coating system.

5. Evaluation and Mapping Project

In addition to the recommendations outlined above, various recommendations have been developed as part of the on-going Evaluation and Mapping Project, complimenting the work being completed by the CWMP/EIR.. In general, this project consists of investigation and mapping of the Town's wastewater and stormwater infrastructures, inspection of the infrastructure manholes and catch basins, and infiltration/inflow analysis of the Brant Point wastewater collection system. The existing wastewater collection system consists of sewers ranging in size from 4 to 30 inches in diameter and a total length of approximately 34 miles or approximately 180,000 linear feet. Most sewers are vitrified clay with oakum-mortar joints. The existing stormwater collection system consists of pipes ranging is size from 8 to ## inches in diameter and a total length of approximately ## miles or approximately ## linear feet with approximately outfalls discharge stormwater into Nantucket Harbor and various other surface water bodies and wetlands. The following is a summary of the work completed to date, including recommendations, and proposed work to be completed:

Wastewater Infrastructure

Since an Infiltration/Inflow (I/I) and Sewer System Evaluation Survey (SSES) report was completed in February 1991, the Town has implemented most of the recommendations, including: notifying property owners with illegal connections to remove such connections, replacement of sewer lines, developing a flushing program of the entire system to minimize buildup of debris and maintain hydraulic capacity, manhole and sewer line rehabilitation, and requiring restaurants to install grease traps. In addition, the Town is currently removing catch basins, sump pumps and roof leaders from the sanitary sewers. Although the Town has continued in its efforts to identify and reduce or eliminate sources of infiltration/inflow, the Town has experienced excessive infiltration/inflow particularly during and after major storm events. Therefore, the Town determined that it was necessary to further eliminate and/or reduce infiltration/inflow in order to gain additional capacity out of the existing system to allow growth in the Town. In addition, infiltration/inflow analysis is a major part of the Administrative Consent Order (ACO), ACOP-BO-03-1G002, that the Town entered into with DEP on October 30, 2003.

Phase 1 – Mini-System M1

The Town elected to begin a new round of investigations in one mini-system (M1) already identified by the previous I/I and SSES Report located in the Brant Point Area. This one system accounts for about 10-percent of the total length of the Town's system. In general, the scope of work consisted of performing flow isolation, television inspection, and smoke testing. The results of the investigations are summarized below. Refer to Appendix K for a copy of the report.

Based on the Flow Isolation and Television Inspection results, the recommended repairs include removing and replacing sewer lines due to excessive sags, spot repairs for short stretches of sags and cracked joints, and capping open clean outs. For Minisystem M1 there is a total amount of 28 linear feet of spot repairs, 4,146 linear feet of pipe to be removed and replaced, 1,646 linear feet of pipe to be tested and sealed, and capping four open cleanouts.

Based on the smoke testing results, the recommended repairs for specific pipelines located within Minisystem N1, include disconnecting roof leaders, one catch basin, and a driveway drain, and re-routing the connections into the stormwater system. The other recommendations are to raise one depressed manhole cover and to cap previously disconnected roof leaders. For Minisystem N1 there is a total 20 roof leaders that require disconnection and re-routing to the stormwater system. About 45.5 percent of the illegitimate inflow is from roof leaders in this minisystem. The most critical of these roof leaders is the four roof leaders located at No. 19 Liberty Street. These roof leaders provide a peak inflow rate of about 74,353 gallons per day or approximately 27 percent of the total inflow found in the minisystem. The other large contributor to excessive inflow is one catch basin located at No. 3 Hiller Lane. Indications are that this catch basin was added over the existing sewer to offer relief from street flooding during times of large storm events. This one catch basin is contributing more than 50 percent of the total inflow found coming into the Minisystem N1.

Phase 2 – Remainder of the System

Based on the results of the infiltration/inflow analysis performed in Phase 1, the Town has elected to continue with the new round of investigations for the reminder of the system. The study will follow the scope of work performed in Phase 1 and in accordance with "Guidelines for Performing Infiltration/Inflow Analyses and Sewer System Evaluation Survey dated January 1993, a publication of the Massachusetts Department of Environmental Protection (DEP). Evaluation of the reminder of the wastewater infrastructure will lead to completion of an I/I and SSES Report with recommendations to rehabilitate the problem sources.

Stormwater Infrastructure

The Town of Nantucket proposed to provide water quality improvements (sediments from first flush events) to the existing outfalls, discharging into Nantucket Harbor, of their drainage system in the downtown area. The ongoing project will entail proposed infiltration of stormwater in the upper reaches of these watershed areas; offline detention where available in the watershed; and near the outfall, the installation of a vortechnic type water treatment structure for treatment of the first flush, with by-pass of the larger storm events. This project will determine the calculation of the flow at the outlet pipes, and conceptual plans for water quality treatment within the individual watershed areas. A later work effort, not included in this project, will be an individual catch basin watershed analysis and pipe system analysis report to be provided during the final design of the water quality treatment for the drainage systems.

Geographic Information System (GIS) Mapping

In order to properly operate and maintain the wastewater and stormwater infrastructures, and to plan for necessary upgrades and expansion of the infrastructures, detailed mapping becomes a key component. Therefore, the Town of Nantucket elected to develop wastewater and stormwater maps that accurately depict the location, sizes, materials of construction, and condition of the wastewater and stormwater infrastructures. The following summarizes the two phases of this project:

Phase 1 - Mapping

Performed topographic survey of the existing and drainage manholes and catch basins in order to determine the elevations of each manhole rim, manhole invert, and inverts of accessible inlet and outlet pipes.

Performed visual inspections of wastewater and drainage manholes. Prepared inspection reports for manholes that included the following: size of manhole, material of construction of the manhole, general physical condition of manhole, location of inlet and outlet pipes, sizes of inlet and outlet pipes. Digital photos of each manhole and structure were taken.

Performed visual inspections of existing catch basins. Prepared inspection reports for each located catch basin that included the following: size of catch basin, material of construction of the catch basin, general physical condition of catch basin, location of inlet and outlet pipes, sizes of inlet and outlet pipes. Digital photos of each catch basin were taken.

Created specific GIS data layers of all information obtained which will be incorporated into the overall Island-wide GIS Database. The following GIS data layers created consist of the location of pipeline, manholes, catch basins and outfalls for the existing wastewater infrastructure and the existing drainage infrastructure.

Phase 2 – Attribute Enhancements

Phase 2 of the Evaluation and Mapping Project will consist of adding attribute enhancements to the mapping created in Phase 1. In general, these attribute enhancements are anticipated to consist of: (a) pipe size, material and condition; (b) manhole size, material and condition; (c) catch basin size, material and condition; (d) rim and invert elevations; and (e) recommended wastewater infrastructure improvements, and recommended drainage infrastructure improvements.

B. INSTITUTIONAL IMPACTS

The recommended wastewater collection, transmission and treatment facilities are currently being planned, designed and constructed under the guidance and direction of the Nantucket Board of Selectmen and Department of Public Works. In order to manage and operate the recommended wastewater collection, transmission and treatment facilities, the Town will need to implement several institutional and system management procedures. The first being the designation and delineation of sewer and septic overlay districts on Island in order to define service areas. The recommended institutional arrangements recommended for implementation are as follows and were previously detailed in Section 4.0 of this report:

- Establishment of Sewer and Septic Overlay Districts;
- Review of the Current Sewer Use Rules and Regulations;
- Cost Recovery Plan;
- Review of Current Sewer User Charge System;
- Review of Sewer System Expansion Control Policy;
- Review of Sewerage System Staffing and Operations Plan;
- Review of Current System Construction Standards;
- Development of a Septage Management Plan; and
- Water Conservation Program.

C. ENVIRONMENTAL IMPACTS

1. General

When determining the recommended plan for each Study Area, it is important to take into consideration and identify and mitigate any environmental impacts. The following environmental impacts were noted:

2. Historical, Archaeological, Cultural, Conservation and Recreation

There are no known impacts to historical, archeological, cultural, conservation or recreational resources for any of the study areas. A Step I Historical and Archeological Survey was conducted for the FAA site and the proposed expansion area of the Surfside Wastewater Treatment Facility. The survey showed that there would be no impacts on those sites. A Project Notification Form (PNF) has been filed with the Massachusetts Historical Commission for these two areas. Refer to Appendix G for a copy.

Since, the Administrative Consent Order issued by the Massachusetts Department of Environmental Protection dated October 30, 2003, requires that the Phase III CWMP/FEIR document by completed by March 30, 2004, and that archaeological reviews cannot be conducted once the ground is frozen, the Town was not able to obtain the necessary permits to conduct the intensive archaeological review prior to the filing of the Phase III CWMP/FEIR document. Therefore, the Town will conduct an intensive archaeological review, according to the regulations, as part of the design phases of the Surfside WWTF Upgrade and FAA property.

3. Wetlands, Flood Plains, and Agricultural Lands

All Study Areas will temporarily impact wetlands. Construction of all collection systems will potentially impact the 100-foot wetland buffer zone. The impacts would be temporary and associated with the construction of sewer infrastructure. Any impacts would be mitigated by erosion control during construction. The Conservation Commission and the DEP will review all erosion control measures during the Notice of Intent process.

4. Zones of Contribution of Existing and Proposed Water Supply Sources

None of the recommended plans will impact the Zones of Contribution.

5. Surface and Groundwater Resources Including Nantucket and Madaket Harbor Watersheds

None of the recommended plans will negatively impact surface and groundwater resources.

6. Displacements of Households, Businesses and Services

None of the recommended plans will cause displacement of households or businesses.

7. Noise Pollution, Air Pollution, Odor and Public Health Issues Associated with Construction and Operation

There will be some temporary construction noise associated with any construction involved with the recommended plan. Limiting the hours and the days of construction will mitigate the construction noise impacts. Any impacts associated with these alternatives will be mitigated in the final design.

8. Violation of Federal, State or Local Environmental and Land Use Statutes or Regulations and Plans Imposed by Such Statutes and Regulations

None of the recommended plans will violate any of the Federal, State or Local Environment and/or Land Use Statutes or Regulations and plans imposed by any of the statutes and regulations.

9. Changes in Development and Land Use Patterns

Building a communal system on the FAA site would have positive impact to the Madaket and Warren's Landing area. The parcel has the potential for high-density development with the current zoning and land use patterns in place since the parcel contains approximately 100 acres. Deducting for roadways and dividing the resultant by the 2-acre zoning results in about 40 residential house lots. This analysis does consider the potential for the property to be used for a Chapter 40B development that would results in a much higher density development. This kind of development would cause a long-term negative change in development and land use patterns and potential impacts to the environment, drinking water supplies, wastewater disposal, schools, and Town services.

10. Pollution Stemming from Changes in Land Use

There will be no pollution stemming from changes in land use.

11. Damage to Sensitive Ecosystems

There will be no damage to sensitive ecosystems as part of the recommended plans for any of the Study Areas.

12. Socioeconomic Pressures for Expansion

Socioeconomics would not be affected by the recommended plan.

D. CAPITAL, OPERATION AND MAINTENANCE COSTS

1. Capital Costs

The estimated Capital Cost for the recommended plan contained in this CWMP/FEIR is $92.1 million (Present Day Cost). As detailed, this capital cost includes furnishing and installing gravity sewer pipes, low pressure sewer pipes, excavation and backfill, ledge removal, paving; dewatering, loam and seeding, pumping stations, upgrade to the Surfside WWTF, Madaket WWTF, engineering (design and construction), legal, fiscal, administrative, and contingency costs. Refer to Table 5-8 for estimated Capital Costs for the Recommended Plan.

TABLE 5-8
TOWN OF NANTUCKET
CWMP/FEIR
SUMMARY OF ESTIMATED PROJECT COSTS
FOR CWMP/FEIR RECOMMENDATIONS

Project Description	Estimated Project Cost
Study Area	
Madaket	$11,150,000
Warren’s Landing	$1,830,000
Somerset	$7,620,000
Shimmo	$7,340,000
Monomoy	$6,130,000
Wastewater Treatment Facilities	
Surfside WWTF	$32,630,000
Siasconset WWTF	Currently Funded
Madaket WWTF	$25,380,000
Total	$92,080,000

The estimated Capital Cost for the recommended plan contained in the Evaluation and Mapping Project is $83.4 million (Present Day Cost). As detailed, this capital cost includes wastewater infrastructure rehabilitation for the Brant Point Area, infiltration/inflow study for the remainder of the wastewater collection system, wastewater rehabilitation for the remaining wastewater collection system, stormwater outfall rehabilitations and upgrades, stormwater infrastructure rehabilitation and upgrades, and attributes enhancements to the GIS mapping. Construction projects include furnishing and installing pipes, excavation and backfill, ledge removal, paving; dewatering, loam and seeding, engineering (design and construction), legal, fiscal, administrative, and contingency costs. Engineering projects include legal, fiscal, administrative, and contingency costs. Refer to Table 5-9 for estimated Capital Costs for the Recommended Plan.

TABLE 5-9
TOWN OF NANTUCKET
CWMP/FEIR
SUMMARY OF ESTIMATED PROJECT COSTS
FOR EVALUATION AND MAPPING RECOMMENDATIONS

Project Description	Estimated Project Cost
Wastewater	
Infiltration/Inflow – Phase 1	
Study	Currently Funded
Rehabilitation	$2,140,000
Infiltration/Inflow – Phase 2	
Study	$1,100,000
Rehabilitation	$30,870,000
Infrastructure Improvements	$9,570,000
Stormwater	
Outfalls	
Study	Currently Funded
Rehabilitation	$27,840,000
Infrastructure	
Study	Currently Funded
Rehabilitation	$11,750,000
GIS Mapping	
Phase 1	Currently Funded
Phase 2	$50,000
Total	$83,320,000

The most user-friendly funding option for this project is public financing through the State Revolving Fund (SRF) Loan program which would finance the eligible capital cost. The SRF Loan Program is a modified continuation of prior Massachusetts Department of Environmental Protection (DEP) financial assistance programs (grants) and allows communities to receive low interest loans with a payback period of up to 20 years.

This Program is financed through the Massachusetts Water Pollution Abatement Trust (Trust), which was established by Chapter 275 of the Acts of 1989 (The Hayes Act), as amended (Chapter 29C). Under Chapter 29C financial assistance is offered to public entities for eligible projects at one-half market rate. Currently, the General Court has authorized additional funding (contract assistance) to be paid to the Trust to buy down the interest to 2 percent. The present market rate for AA municipal bonds of approximately 5.5 percent. For wastewater treatment and collection projects, the actual planning and design engineering costs are not eligible for the SRF loan. Each year the DEP's Division of Municipal Services canvasses all of the state's, cities, towns, and districts for projects with a potential to receive financial assistance.

The Town of Nantucket must address the equitable apportionment of the capital costs amongst the either the general pollution, the system users and/or a combination of the two. Typically, there are limited financial resources available to enable a community to undertake such projects. The following sources are frequently used in combination to arrive at a financing solution:

- Federal and/or state funding through grants and/or loans;
- Betterment assessments based on the fixed uniform rate (linear foot frontage and/or property area) or the uniform unit method (number of existing/potential sewer units). Currently the Town of Nantucket bylaw develops betterments based on either total square footage of the lot or linear foot frontage;
- Special assessments such as connection charges, capacity reserve charges, privilege fees, interest, and fines;
- User charges; and
- Property taxes.

Betterment Assessment

A betterment is a tax or charge that is permitted where properties within a limited area receive a special benefit or advantage, other than the general advantage to the community, from the construction of a public improvement which results in an enhancement of the value or use of those properties.

User Fee

A user fee charge is permitted for properties that are connected into the wastewater infrastructure who pay for the cost for the operation and maintenance of the system. Currently, the Town of Nantucket takes the total cost of operation and maintenance of the wastewater infrastructure, wastewater pumping stations and wastewater treatment facilities and divides it equally among the approximately 4,200 users. The Town of Nantucket completed an update of its user fee in December 2001. Refer to Appendix I for a copy of the report.

Funding Scenarios

As of the filing of this Document, the Town of Nantucket had not determined how to finance the recommendations of the CWMP/FEIR and Evaluation and Mapping Project. However, the Town has determined that four projects are needed to be placed on the Spring 2004 Town Meeting. These projects consist of the: (1) design phase of the Surfside WWTF Upgrades; (2) Brant Point Rehabilitation; (3) Infiltration/Inflow Study; and (4) the establishment of the Town and Siasconset Sewer Districts. These projects will be paid for through bonds debt service cost, which will be recovered through property taxes. In order to reduce the financial burden to the tax payers, the Town applied for SRF funding for the Brant Point Rehabilitation and Infiltration/Inflow Study Projects. Discussions with the DEP have indicated that both of these projects have been accepted to receive low-interest loans through the program.

2. Operation and Maintenance Costs

In addition to the capital cost for designing and constructing the recommend plan contained in the CWMP/FEIR, there will also be an annual cost for the Town to both operate and maintain the system. The estimated Operation and Maintenance Cost for the recommended plan is $2.73 million (Present Day Cost). The operation and maintenance cost associated with the system primarily consists of costs to operate and maintain the wastewater collection system, pumping stations, force mains, maintenance on the mechanical pumping equipment, annual replacement costs, power costs, and WWTFs. In areas where low pressure sewers are part of the recommend plan, the Town has elected to have the individual homeowners operate and maintain the individual grinder pump units. Therefore, the homeowners will be required to handle all future service issues and associated costs. Refer to Table 5-10 for estimated Operation and Maintenance Cost for the Recommended Plan.

TABLE 5-10
TOWN OF NANTUCKET
CWMP/FEIR
ESTIMATED OPERATION AND MAINTENANCE COSTS
FOR CWMP/FEIR RECOMMENDATIONS

Description	Estimated Operation and Maintenance Cost
Wastewater Treatment Facilities	
Surfside	$1,290,000
Siasconset	$270,000
Madaket	$400,000
Infrastructure	$520,000
Septage Management Plan	$250,000
Total	$2,730,000

In addition to the capital cost for designing and constructing the recommend plan contained in the Evaluation and Mapping Project, there will also be an annual cost for the Town to both operate and maintain the system. The estimated Operation and Maintenance Cost for the recommended plan is $44,000 (Present Day Cost). The operation and maintenance cost associated with the system consists of costs to operate and maintain the stormwater collection system and to update the wastewater and stormwater mapping.

TABLE 5-11
TOWN OF NANTUCKET
CWMP/FEIR
ESTIMATED OPERATION AND MAINTENANCE COSTS
FOR EVALUATION AND MAPPING RECOMMENDATIONS

Description		Estimated Operation and Maintenance Cost
Wastewater Infrastructure		Included Above
Stormwater Infrastructure		$29,000
GIS Mapping		$15,000
	Total	$44,000

E. IMPLEMENTATION PLAN

The recommended plan is estimated to be designed and constructed over a twelve-year period. The recommended plan has been divided into seven construction phases. The construction phases were developed based on: (1) the need of an area to be serviced as identified in the CWMP/EIR Phase I Document; (2) funding constraints; (3) recommended on-site solutions; (4) recommended off-site solutions; and (5) minimizing construction related disruptions to the Town. Table 5-12 and Table 5-13 summarizes the recommended on-site solutions, recommended off-site solutions, length of time, estimated costs under each recommended solution and area of construction phase as well as funding mechanisms required under the Capital Improvement Program FY 2004-2014 for Wastewater and Stormwater Infrastructure presented to the Town. Once the Town, regulatory and non-regulatory agencies and the public approve the recommended plan, the recommendations can by further broken down into construction contracts.

TOWN OF NANTUCKET
DEPARTMENT OF PUBLIC WORKS
CAPITAL IMPROVEMENT PROGRAM FY 2004-2014
FOR CWMP/FEIR RECOMMENDATIONS

Comprehensive Wastewater Management Plan

Solution	Category	Project	Estimated Project Cost (As of 09/03)	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	Remainder
On-Site Solution	Septage Management Plan	Cisco, Miacomet, Surfside, Tom Nevers High Density, Tom Nevers Low Density, Town-WPZ, Remainder of Island, Pocomo*, Polpis*, Quidnet*, Wauwinet*													
Off-Site Solution	Wastewater Treatment Facility	Surfside WWTF	$ 32,630,000	$ 2,250,000		$ 32,230,000									
Off-Site Solution	Wastewater Treatment Facility	Siasconset WWTF													
Off-Site Solution	Wastewater Treatment Facility	Madaket WWTF	$ 25,380,000		$ 1,800,000		$ 25,820,000								
Off-Site Solution	Infrastructure Expansion	Madaket	$ 11,150,000		$ 790,000			$ 11,680,000							
Off-Site Solution	Infrastructure Expansion	Monomoy	$ 6,130,000						$ 490,000		$ 3,840,000				
Off-Site Solution	Infrastructure Expansion	Somerset	$ 7,620,000					$ 590,000		$ 8,470,000					
Off-Site Solution	Infrastructure Expansion	Shimmo	$ 7,340,000							$ 600,000		$ 8,660,000			
Off-Site Solution	Infrastructure Expansion	Warren's Landing	$ 1,830,000		$ 130,000				$ 1,980,000						
			$ 92,080,000	$ 2,250,000	$ 2,720,000	$ 32,230,000	$ 25,820,000	$ 12,270,000	$ 2,470,000	$ 9,070,000	$ 3,840,000	$ 8,660,000	$ -	$ -	

* Wastewater disposal recommendation(s) for these study areas to be based on the results of the on-going MA DEP Estuaries Project.

Legend

- Project Currently Funded
- Project Required By ACO
- Project Recommended
- Town Meeting Appropriation for Design Phase
- Town Meeting Appropriation for Construction Phase
- Construction Duration

TOWN OF NANTUCKET
DEPARTMENT OF PUBLIC WORKS
CAPITAL IMPROVEMENT PROGRAM FY 2004-2014
FOR EVALUATION AND MAPPING RECOMMENDATIONS

Program	Category	Project	Item	Estimated Project Cost (As of 09/03)	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	Remainder
Evaluation & Mapping	Wastewater	Infiltration/Inflow	Study - Area M-1													
			Construction	$ 2,140,000		$ 150,000		$ 2,180,000								
			Study - Remainder	$ 1,100,000	$ 1,100,000											
			Construction	$ 30,870,000			$ 2,260,000		$ 2,810,000	$ 2,900,000	$ 2,990,000	$ 3,070,000	$ 3,170,000	$ 3,260,000	$ 3,360,000	TBD
		Infrastructure Improvements		$ 9,570,000				$ 720,000		$ 10,330,000						
	Stormwater	Outfalls		$ 27,840,000					$ 2,160,000		$ 2,990,000	$ 3,070,000	$ 3,170,000	$ 3,260,000	$ 3,360,000	TBD
		Infrastructure		$ 11,750,000					$ 910,000		$ 13,060,000					
	GIS Mapping	Phase I														
		Phase II		$ 50,000	$ 50,000											
				$ 83,320,000	$ 1,150,000	$ 150,000	$ 2,260,000	$ 2,900,000	$ 5,880,000	$ 13,230,000	$ 19,040,000	$ 6,140,000	$ 6,340,000	$ 6,520,000	$ 6,720,000	
				$ 175,400,000	$ 3,400,000	$ 2,870,000	$ 34,490,000	$ 28,720,000	$ 18,150,000	$ 15,700,000	$ 28,110,000	$ 9,980,000	$ 15,000,000	$ 6,520,000	$ 6,720,000	

Legend

- Project Currently Funded
- Project Required By ACO
- Project Recommended
- Town Meeting Appropriation for Design Phase
- Town Meeting Appropriation for Construction Phase
- Construction Duration

This type of program needs to be completed over many years. Based on the scope of work and the financial commitment required for this recommended plan and other Town projects, it is recommended that be completed over a 10 to 20-year period. The following is a list of specific tasks for implementation for each year of the recommended plan in chronological order:

- Appropriate project funds at the Annual April Town meeting for the Design Phase;
- Execute a design phase engineering contract and proceed with the engineering design in mid-July;
- Prepare and submit a Project Evaluation Form (PEF) to the DEP. Currently, PEF's are due to the DEP by August 15 of each year. The PEF should include documentation that the Town has appropriated funds for the design and construction. The submittal of the PEF will allow the DEP to review and assign priority points to get the project on the calendar year "Priority List" for funding on January 1. Submittal of this CWMP to the DEP for approval will result in a higher rating for each project;
- Appropriate project funds at the Annual April Town meeting for the Construction Phase;
- Execute a construction phase engineering contract and proceed with the SRF Loan funding application in July;
- Prepare and submit SRF Loan funding application and contract documents (plans and specifications) for construction of the project. Currently, loan applications and contract documents are due to the DEP by October 15;
- Submit required Permit Applications by October 15. Permits and environmental determinations should be in hand within 2 to 3 months from the date of submittal, depending on the review and approval by regulatory agencies. It is anticipated that a Conservation Commission Notice of Intent will be required for each project. In addition, it should be noted that completed contract documents are required for most permit applications;
- DEP approves the SRF application for funding and contract documents by December 31;
- Receive approval from DEP to advertise and publicly bid the project by February 1;
- Advertise and publicly bid the project (typically six to ten weeks depending upon on the size and type of project);
- Receive bids and prepare a SRF Part B for the project (typically two to four weeks to prepare Part B depending upon the size of project and completeness of the contractor information);
- Submit Part B to DEP for review and approval. Receive approval from DEP to award the project (typically up to six to eight weeks for DEP review and approval);
- Award to contractor (typically up to two months after bid opening dependent on DEP

review and approval);

- Construction of project and SRF monthly draw-downs; and
- Complete record plans and do DEP SRF Closeout; (typically up to two months depending upon size of the project).

Section 6.0

Final Environmental Impact Report

6.0 FINAL ENVIRONMENTAL IMPACT REPORT

A. PROJECT DESCRIPTION

1. General

This Final Environmental Impact Report (FEIR) presents an analysis of the impacts associated with the construction of the recommend wastewater treatment plan for the Town of Nantucket. This FEIR has been prepared in order to satisfy the procedural requirements of the Massachusetts Environmental Policy Act (MEPA). The file number issued for the Project by the Executive Office of Environmental Affairs (EOEA) is EOEA No. 12617.

The Secretary's Certificate on the ENF and Phase I Report was issued on October 10, 2001 by the Secretary of Environmental Affairs (Secretary). The complete MEPA Certificate and the responses to the comment letters are included in Appendix L. Section 1.0 is devoted in its entirety to addressing the comments received from the Secretary in the MEPA Certificate and in a letter dated May 17, 2002, which is also included in Appendix L.

The Secretary's Certificate on the Phase II Report was issued on December 1, 2003 by the Secretary of Environmental Affairs (Secretary). The complete MEPA Certificate and the responses to the comment letters are included in Appendix M.

2. Summary

The recommended plan for the Town of Nantucket is detailed in Section 5.0 of this report. The plan includes the upgrade and expansion of the existing Surfside Wastewater Treatment Facility, and the design and construction of a new wastewater treatment facility in Madaket. The new facility in Madaket will be located on the FAA site. The new facility will include the treatment and disposal of wastewater for the Madaket and the Warren's Landing needs areas. The recommended plan also includes the treatment of the wastewater for the Needs Areas of Shimmo, Somerset, and Monomoy to be treated within the existing roadways.

3. Needs Areas

The Needs Areas are detailed in Sections 1.0 and 5.0 of this Report and include the following Study Areas:

Madaket	Shimmo
Monomoy	Somerset
Pocomo	Town WPZ
Polpis	Warren’s Landing
Quidnet	Wauwinet

4. Disposal Site Alternatives

The entire Phase III Document details the disposal site alternatives.

5. Threshold Exceedances

The proposed project required the FEIR due to exceedance of the MEPA regulation Section 11.03 (5) a3 dealing with the construction of more than 10 miles of new sewer. The proposed project includes approximately 22 miles of sewer main in the areas of Madaket, Warren’s Landing, Shimmo, Somerset, and Monomoy.

B. WATER SUPPLY

1. General

The Secretary’s Certificate requests more information concerning the water supply to the Town and how the existing and projected water use fits with the Water Management Act (WMA) approval for the Town. This is detailed in the Water Balance completed for the Island, which is included in Section 2.0 of this Report. This review shows the effects of the selected alternative on the Water Management Act.

2. Existing Conditions

The water supply on the Island is from groundwater sources withdrawn for the sole source aquifer. The water is withdrawn through seven wells on the Island and is distributed by two municipal water companies. The existing water use is detailed in the Water Balance contained in Section 2 of this Report.

3. Proposed Water Use

The proposed water use is calculated to show only the effects of the build out of the Needs Areas that are proposed to be sewered. The build out is based on current buildable lots as defined by current zoning and state land use codes from the Town assessor database. The proposed water use for the Needs Areas is assumed to be a worst-case scenario with the build out of the area.

Madaket

In the Madaket Study Area the current water supply comes from individual private water wells. The future potential water use is assumed to come from private water supplies and will not impact the Water Management Act. If municipal water use is extended to these areas at some point in the future, the DEP and other state agencies would review the expansion in accordance the Water Management Act.

Warren's Landing

Table 6-1 shows the current water supply for Warren's Landing Study Area as the initial yearly average flow. The initial yearly average flow for the Warren's Landing Study Area is 12,765 gpd. The design yearly average flow was calculated based on the build out of current buildable lots and was calculated to be 23,140 gpd. The water demand in Warren's Landing Study Area may increase by up to a yearly average 10,375 gpd.

Somerset

Table 6-2 shows the current water supply for Somerset Study Area as the initial yearly average flow. The initial yearly average flow for the Somerset Study Area is 30,325 gpd. The design yearly average flow was calculated based on the build out of current buildable lots and was calculated to be 88,740 gpd. The water demand in Somerset Study Area may increase by up to a yearly average 58,415 gpd.

TABLE 6-1
TOWN OF NANTUCKET
CWMP/FEIR
WARREN'S LANDING STUDY AREA
WATER USE DESIGN CONDITIONS

Design Condition	Unit: Type	Unit: Number	Unit: Flow (gpd)	Total Flow (gallons): Off Season	Total Flow (gallons): Peak Season	Total Flow (gallons): Year	Average (gpd)
Initial	Residential	69	185	3,893,325	765,900	4,659,225	12,765
	Commercial	0	320	0	0	0	0
							12,765
Design	Residential	89	260	7,057,700	1,388,400	8,446,100	23,140
	Commercial	0-	345	0	0	0	0
							23,140
						Difference	10,375

TABLE 6-2
TOWN OF NANTUCKET
CWMP/FEIR
SOMERSET STUDY AREA
WATER USE DESIGN CONDITIONS

Design Condition	Unit: Type	Unit: Number	Unit: Flow (gpd)	Total Flow (gallons): Off Season	Total Flow (gallons): Peak Season	Total Flow (gallons): Year	Average (gpd)
Initial	Residential	157	185	8,858,725	1,742,700	10,601,425	29,045
	Commercial	4	320	390,400	76,800	467,200	1,280
							30,325
Design	Residential	336	260	26,644,800	5,241,600	31,886,400	87,360
	Commercial	4	345	420,900	82,800	503,700	1,380
							88,740
						Difference	58,415

Shimmo

Table 6-3 shows the current water supply for the Shimmo Study Area as the initial yearly average flow. The initial yearly average flow for the Shimmo Study Area is 25,295 gpd. The design yearly average flow was calculated based on the build out of current buildable lots and was calculated to be 80,165 gpd. The water demand in Shimmo Study Area may increase by up to yearly average 54,870 gpd.

TABLE 6-3
TOWN OF NANTUCKET
CWMP/FEIR
SHIMMO STUDY AREA
WATER USE DESIGN CONDITIONS

Design Condition	Unit Type	Unit Number	Unit Flow (gpd)	Total Flow (gallons) Off Season	Total Flow (gallons) Peak Season	Total Flow (gallons) Year	Average (gpd)
Initial	Residential	135	185	7,617,375	1,498,500	9,115,875	24,975
	Commercial	1	320	97,600	19,200	116,800	320
							25,295
Design	Residential	307	260	24,345,100	4,789,200	29,134,300	79,820
	Commercial	1	345	105,225	20,700	125,925	345
							80,165
						Difference	54,870

Monomoy

Table 6-4 shows the current water supply for the Monomoy Study Area as the initial yearly average flow. The initial yearly average flow for the Monomoy Study Area is 34,580 gpd. The design yearly average flow was calculated based on the build out of current buildable lots and was calculated to be 98,100 gpd. The water demand in Monomoy Study Area may increase by up to yearly average 63,520 gpd.

TABLE 6-4
TOWN OF NANTUCKET
CWMP/FEIR
MONOMOY STUDY AREA
WATER USE DESIGN CONDITIONS

Design Condition	Unit Type	Unit Number	Unit Flow (gpd)	Total Flow (gallons) Off Season	Total Flow (gallons) Peak Season	Total Flow (gallons) Year	Average (gpd)
Initial	Residential	180	185	10,156,500	1,998,000	12,154,500	33,300
	Commercial	4	320	390,400	76,800	467,200	1,280
							34,580
Design	Residential	372	260	29,499,600	5,803,200	35,302,800	96,720
	Commercial	4	345	420,900	82,800	503,700	1,380
							98,100
						Difference	63,520

Impacts to the Water Management Act

If the Needs Areas are built out according to current zoning and land uses, then the water demand from these areas may increase by up to a total of 187,180 gpd. The total amount of water that the Island is allowed to withdraw according to the Water Management Act is 1.54 million gallons per day (mgd). In the year 2001, the Town withdrew an average of 1.317 mgd. The potential increase based on the design flow selected alternative would only increase the withdrawal rate by up to 1.50 mgd. This increase would not exceed the current Water Management Act approval.

C. MITIGATION MEASURES

The Town is proactive concerning any potentially negative impacts from the selected alternatives for this project. The majority of temporary negative impacts will come from construction work. Any temporary construction impacts will be required to be mitigated in the construction contract. The contract will include mitigation measures that would not allow any construction in roadways during the summer months, holidays. Construction would not be allowed during key Town events, such as the Christmas Stroll and Daffodil Weekend.

D. EXECUTIVE ORDER 385/PLANNING FOR GROWTH

The Town of Nantucket has a Planning and Economic Development Commission (NP&EDC). The NP&EDC has created a planning document titled, "Charting the Future: The Nantucket Comprehensive Community Plan." The Town agencies have worked together to find a recommended solution for the future planning and growth in Nantucket. The recommended solution takes into account the "Charting the Future: The Nantucket Comprehensive Community Plan" and Executive Order 385. The Community Plan's goal is not to end growth, nor accelerate it but rather to develop alternatives in order to manage it, and to keep it at a pace and level where the Island is still able to:

- Protect the working community of Nantucket and provide for the housing needs of those whose choose to live on the Island;
- Protect the open spaces and natural resources;
- Enhance the ability of Nantucketers to live and work on the Island;
- Protect the historical integrity of the land and buildings;
- Maintain the strong tourism-based economy;
- Maintain access to the beaches; and
- Provide a healthy environment for the residents.

The Phase III document has taken into consideration Executive Order 385 in its recommended wastewater collection, treatment and disposal plans for the Island. For example, the recommended solution for the Madaket and Warren's Landing Study Areas incorporates low-pressure sewers instead of gravity sewers. This system is designed as a calculated flow base system for existing developed lots and those designated as buildable in the future according to the current state land use codes and local zoning. This will require local approval, special legislation and the development of new zoning overlays delineating sewer and septic districts. While the introduction of sewer infrastructure in itself does not serve to promote or deny growth, the local zoning and by-laws will. The intent of this CWMP/FEIR is to solve the problems of the existing development while at the same time not serving to promote sprawl or unchecked development in more rural, less dense areas on Island. Section 4.0 details the recommended measures to be taken by the Town in order to conform to not only Executive Order 385 but its own Community Plan goals as well.

As an additional proactive approach to keep unwarranted growth in check, the Town has recently completed a Septage Management Plan (SMP) for those areas on Island currently recommended for long-term sustainability with their current on-site wastewater disposal systems. Once implemented, this SMP will serve prevent the Town of Nantucket from having to finance the high cost of extending municipal sewers into additional areas in the future. A well managed SMP has the potential to provide the means with which to prevent areas on Island from over development due to the construction of infrastructure and utilities in areas previously not serviced by such as well as preserving the community structure that originally attractive residents to the Island.

Section 7.0

Review of Public Participation Program

7.0 REVIEW OF PUBLIC PARTICIPATION PROGRAM

A. GENERAL

As part of the scope of this Comprehensive Wastewater Management Plan/Environmental Impact Report (CWMP/EIR), the Town of Nantucket has conducted an extensive public education program. The purpose of this public education/participation program is to inform the public of the scope and progress of the planning study, to describe the results of the wastewater needs analysis and siting alternatives selection process, and to encourage public input throughout the entire planning process.

Earth Tech, along with the Town Administration, Town of Nantucket Department of Public Works and Nantucket Planning and Economic Development Commission, undertook a comprehensive public participation campaign in order to educate and inform all interested parties on the Island of all the on-going CWMP/EIR work. A presentation of the CWMP/EIR was made to the annual meeting of the Nantucket Civic League on June 2, 2003. This organization represents members of each Island village/community. Through this initial meeting with the Nantucket Civic League, a number of additional, individual community meetings were recommended and arranged. A CWMP/EIR presentation was made at the annual meeting of the Tristam's Long Pond Association in Madaket on August 9, 2003. The CWMP/EIR was also on the annual meeting agenda at the Quidnet-Squam Association on August 11, 2003. The Nantucket Civic League held another presentation at the close of the Phase II CWMP/DEIR on November 3, 2003. Through continued communication with these member groups, this effort will continue.

Additional meetings and presentations have been held with Island groups including the Nantucket Land Council on August 8, 2003. As a result of this meeting, an additional Depository has been established at the Land Council's Ash Lane office.

A meeting with the Nantucket Conservation Foundation resulted in the cooperative efforts of soil and groundwater testing in the Madaket area.

Earth Tech, in conjunction with the Department of Public Works, has also initiated a poster campaign to educate both citizens and visitors to the Island about the Comprehensive Wastewater Management Plan. Posters have been distributed to the Planning and Economic Development Department, Town Hall, the Office of Marine Fisheries, the Department of Public Works, and the Library and have been posted in the Steamship Authority and the Airport. Tri-fold brochures have also been distributed through the Department of Public Works. A copy of the poster and tri-fold brochure can be found in Appendix L.

In addition to the six Depositories located on Island, the Phase I and II Reports have been posted on the Town's website under the Department of Public works and can be accessed at http://www.nantucket-ma.gov/.

B. PUBLIC MEETINGS

Throughout the development of the CWMP/EIR, the Town of Nantucket and Earth Tech have been proactive in providing timely and informative information to the residents. All meetings held with Town Officials have been posted as required in Town Hall and have been advertised in the local newspaper(s). The following is a summary of the meetings and workshops that have been held regarding this project.

1. The Public Informational Meeting was held on July 29, 1999 to present the results of the Phase I CWMP/EIR Document. The Public Informational Meetings were widely publicized and posted in the Town Hall.

2. A public meeting was held with the Nantucket Planning and Economic Development Commission on September 4, 2001.

3. A Public Informational Meeting was held on October 21, 2003 to present the results of the Phase II CWMP/DEIR Document. The Public Informational Meetings were widely publicized and posted in the Town Hall.

4. At the conclusion of this last and final phase, Phase III, Final CWMP/EIR, a public hearing will be scheduled and held on Island to present the final recommended plan.

5. A Capital Improvement Plan Workshop, which outlined the financial aspects of the CWMP/EIR, was held with Town Officials on September 22, 2003, with the public in attendance.

6. A workshop on the build-out analysis contained in the CWMP/EIR Documents was held with the Board of Selectmen, the NP&EDC and other Town Officials on January 12, 2004.

7. Forum on Wastewater and Solid Waste Management sponsored by the Alliance of Nantucket's Working Community on November 20, 2003. Presentations were made by the Board of Health, Department of Public Works and Earth Tech, Marine Department, Conservation Commission, Wannacomet water Company and Waste Options.

8. Regularly scheduled meetings have been held with the Nantucket Board of Selectmen and the Department of Public Works. Earth Tech presented a workshop with the Board of Selectmen and all Town Department Heads on the progress of the CWMP/EIR on October 7, 2002. There are also, regularly scheduled meetings with state and federal regulators, including the DEP and representatives from the EOEA Nantucket Watershed Team and the Massachusetts Estuary Project.

9. A Madaket Harbor Quality Workshop was held on January 29, 2004 with the following members participating:
   - Town of Nantucket Department of Public Works
   - Town of Nantucket Board of Selectmen
   - The Alliance for Nantucket's Working Community
   - Nantucket Marine and Coastal Resources Department
   - Town of Nantucket Board of Health
   - Town of Nantucket Conservation Commission
   - Massachusetts Department of Environmental Protection
   - Massachusetts Estuaries Program

- Madaket Area Plan Work Group
- Nantucket Planning and Economic Development Commission
- Earth Tech

10. In addition to the above meetings and workshops, the Town of Nantucket and Earth Tech have prepared and presented the results of the CWMP/EIR Documents to various special interest groups such as but not limited to the NP&EDC, Quidnet/Squam Association, Madaket Long Pond Association, Wannacomet Water Company, Tristam's Long Pond Association in Madaket, Nantucket Land Council, Nantucket Civic League, and Nantucket Marine and Coastal Resources Department.

A copy of all of the public participation literature can be found in Appendix Q.

A newsletter titled, "Understanding Our Wastewater" was developed with the Town Administration and Department of Public Works, which was mailed directly to Nantucket households. The Newsletter summarizes the wastewater planning efforts to date, federal, state and local regulations driving the effort, additional on-going state planning projects and costs associated with the CWMP/EIR. A copy of the newsletter can be found in Appendix R.

C. RESPONSIVENESS SUMMARIES

Earth Tech will prepare and distribute responsiveness summaries after the public hearing. These responsiveness summaries will identify the public participation activities and document significant questions, comments, concerns and suggestions by the public and responses by Town staff and Earth Tech. The responsiveness summaries will be distributed to the depositories, active participants and the mailing list.

D. SUMMARY OF PUBLIC COMMENTS RECEIVED DURING THE MEPA PROCESS

The Town of Nantucket submitted an Environmental Notification Form (ENF) to MEPA on October 1, 2001. The 30-day comment period for the ENF ended on November 1, 2001 and on November 16, 2001, the Executive Office of Environmental Affairs (EOEA) determined that the project required an Environmental Impact Report (EIR) and established a special procedure for review of the required EIR.

The MEPA Certificate (EOEA No. 12617), issued by the Secretary of Environmental Affairs to the Town of Nantucket, requires the preparation of a Comprehensive Wastewater Management Plan/Environmental Impact Report (CWMP/EIR) for the Town and establishes a special procedure for review of this project. The special procedure is a phased review during which the scope for future phases is based in large part on the results of the preceding phase. A project description was included in the MEPA certificate. The Phase II scope is the "Alternatives and Site Identification and Draft Environmental Impact Report (DEIR)" and was finalized upon the completion of Phase I. A MEPA Certificate was issued by the Secretary of Environmental Affairs on December 1, 2003. The Phase III scope is the "Final CWMP/Environmental Impact Report (FEIR)" was finalized upon the completion of Phase II. Each phase of this project is distributed for review according to MEPA regulations. The MEPA Regulations allow for a 30 day review and public comment period following the filing of each report. The filing is advertised in the Environmental Monitor and is also widely publicized through local media, including the Inquirer and Mirror on Island. Therefore, there were ample opportunities for the appropriate public comment period for all interested parties to contribute to the outcome of this project. A copy of the MEPA Certificates and the responses to comments on the Phase I and Phase II Reports are attached in Appendix L and Appendix M, respectively.

In addition to the MEPA public comments allowed under the MEPA process, the Town initiated a "Letter Campaign" based on subsequent public meetings outside of the MEPA Process. This further enabled all interested parties to have their comments heard and questions answered with a direct response. Copies of letters and responses can be viewed in Appendix S.

E. CIRCULATION LIST

Secretary of Environmental Affairs
Executive Office of Environmental Affairs
Attn: MEPA Office
100 Cambridge Street, Suite 900
Boston, MA 02114
(Three Copies)

Department of Environmental Protection
Boston Office
Attn: Ron Lyberger
One Winter Street, 5th Floor
Boston, MA 02108
(Two Copies)

Nantucket Department of Public Works
188 Madaket Road
Nantucket, MA 02554
(Two Copies plus Depository)

Nantucket Board of Selectmen
Town Hall
16 Broad Street
Nantucket, MA 02554
(Six Copies plus Depository)

Department of Environmental Protection

Nantucket Planning & Economic

South East Regional Office
Attn: Frank Mezzacappa
20 Riverside Drive
Lakeville, MA 02347
(Four Copies)

Development Commission
Attn: John Pagini
4 North Water Street
Nantucket, MA 02554
(One Copy plus Depository)

Nantucket Conservation Commission
Attn: Michael Glowacki, Chairman
Town Hall Annex
37 Washington Street
Nantucket, MA 02554

Nantucket Board of Health
Attn: Richard Ray
Town Hall Annex
37 Washington Street
Nantucket, MA 02554

Nantucket Division of Marine Fisheries
Attn: Dave Fronzuto
38 Washington Street
Nantucket, MA 02554

Wannacomet Water Company
Attn: Robert Gardner
One Milestone Road
Nantucket, MA 02554

Massachusetts Historical Commission
Attn: Brona Simon
Massachusetts Archives Building
220 Morrissey Boulevard
Boston, MA 02125

Nantucket Land Council, Inc.
Attn: Linda Holland, Executive Director
Six Ash Lane
P.O. Box 502
Nantucket, MA 02554
(One Copy plus Depository)

Massachusetts Estuary Project
c/o SMAST – Center for Marine
Science & Technology
Attn: Dr. Brian Howes
706 South Rodney French Boulevard
New Bedford, MA 02744-1221

Massachusetts Estuary Project
c/o SMAST – Center for Marine
Science & Technology
Attn: Roland Samimy
706 South Rodney French Boulevard
New Bedford, MA 02744-1221

Division of Marine Fisheries
Attn: Neil Churchill
50A Portside Drive
Pocassett, MA 02559

Coastal Zone Management, Suite 800
Attn: Mr. Todd Callahan
251 Causeway Street
Boston, MA 02114

MassWildlife
Natural Heritage and Endangered
Species Program
1 Rabbit Hill Road
Westborough, MA 01581

Mass. Department of Food & Agriculture
Attn: Marcia Starkey
251 Causeway Street, Suite 500
Boston, MA 02114

CZM Cape Cod & Islands Regional Office
Attn: Truman Henson/Stephen McKenna
P.O. Box 220
Barnstable, MA 02630-0220

Division of Marine Fisheries
Attn: Dr. Jack Schwartz
30 Emerson Avenue
Gloucester, MA 01930

Nantucket Community Association
Attn: Dale Stoodly

Nantucket Civic League
Attn: John W. Atherton, Jr.

917 North Rodney Street
Wilmington, DE 14806

Nantucket Community Association
Attn: William K. Tell, Jr.
660 Steamboat Road
Greenwich, CT 06830

Nantucket Community Association
Attn: Duncan Sutphen
1155 Bowline Drive
Vero Beach, FL 32963

Madaket Conservation Association
Attn: Marjorie Colley
52 Tennessee Avenue
Nantucket, MA 02554

Sylvie O'Donnell
259 Madaket Road
Nantucket, MA 02554

Dr. Robert A. Rudin
15 Starbuck Road
Nantucket, MA 02554

Clark M. Whitcomb
19 Starbuck Road
Nantucket, MA 02554

P.O. Box 181
Nantucket, MA 02554

Tristram's Long Pond Association
Attn: Andrea Murphy
12 Long Pond Drive
Nantucket, MA 02554

Smith's Point Homeowners
Attn: Mr. Thomas B. Erichsen
34 Rhode Island Avenue
Nantucket, MA 02554

Nantucket Sustainable Development Corp.
Attn: Christine B. Silverstein
147 Orange Street
Nantucket, MA 02554

Lars O. Soderberg, P.E.
9 Tennessee Avenue
Nantucket, MA 02554

Deborah B. Bennett
36 South Cambridge Street
Nantucket, MA 02554

Debby Deeley Culbertson
55 Tennessee Avenue
P.O. Box 1237
Nantucket, MA 02554

Section 8.0

SRF Grant/Loan Administration

8.0 SRF GRANT/LOAN ADMINISTRATION

A. GENERAL

As part of the scope of this Town-wide Comprehensive Wastewater Management Plan/Environmental Impact Report (CWMP/EIR), Earth Tech submitted to the Massachusetts Department of Environmental Protection (DEP) a Calendar Year (CY) 2000 Project Priority List/Intended Use Plan (IUP) Project Evaluation Form (PEF) on June 30, 1999.

The "Calendar Year 2000 Intended Use Plan and Project Priority List" was finalized on November 12, 1999 by the Massachusetts Department of Environmental Protection, and the Town-wide Comprehensive Wastewater Management Plan Project was identified on the Intended Use Plan as a project (DEP/BRM Project Number CWSRF 625) eligible for financial assistance from the State Revolving Fund effective January 1, 2000.

On October 13, 2000 Earth Tech prepared and submitted two copies of the Town's SRF Application for the Comprehensive Wastewater Management Plan/Environmental Impact Report for DEP Division of Municipal Services and Water Pollution Abatement Trust review and approval.

A Restricted Project Approval Certificate (PAC) was issued for this project on January 29, 2001. The PAC was restricted until all of the Special Conditions in Exhibit C were satisfied. On November 16, 2001 the Department of Environmental Protection approved the revised Comprehensive Wastewater Management Plan/Environmental Impact Report scope and lifted the restriction. Refer to Appendix T for a copy of the approved Scope of Work.

Grant/Loan administration services are being provided in accordance with DEP financial assistance guidelines and procedures. Liaison among the Town, DEP officials and Earth Tech, and contract administration, are being carried out. Earth Tech is assisting the Town in submitting (on average) monthly SRF drawdown requests to the DEP for reimbursement for costs incurred to undertake the study. Upon completion of the project, the Town and Earth Tech will prepare and submit the required loan closeout documents.

The Town will then be responsible to budget for debt service payments to the Water Pollution Abatement Trust over the 20-year payoff period for this loan.

Report

Phase III - Comprehensive Wastewater Management Plan and Final Environmental Impact Report

Nantucket, Massachusetts

Volume II of III

Prepared for:

Nantucket Department of Public Works
188 Madaket Road
Nantucket, Massachusetts 02554-2623

Prepared by:

Earth Tech, Inc.
196 Baker Avenue
Concord, Massachusetts 01742-2167

March 2004

27355

Phase III - Comprehensive Wastewater Management Plan
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March 2004

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Volumes II and III, Appendices can be reviewed at Depositories